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Atmospheric Gas Engines.

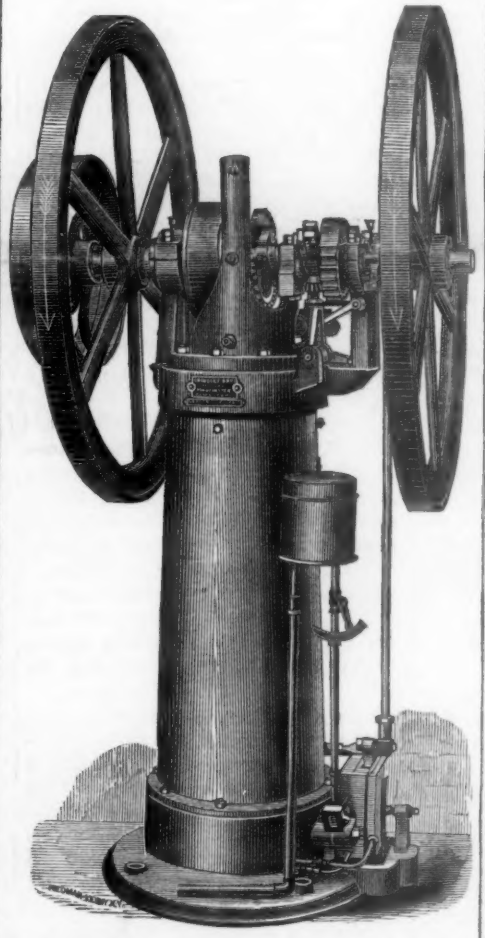
At the meeting of the Institution of Mechanical Engineers in Manchester, on the 27th ult., Mr. E. J. Bramwell, F.R.S., in the chair, a paper on the above subject, with special reference to Otto and Langen's Atmospheric Gas-Engine, written by Mr. Francis W. Crossley, of Manchester, was read, in his absence, by the secretary (Mr. W. P. Marshall). The following is an abstract of the paper:

The Otto and Langen atmospheric gas-engine is not only an exceedingly ingenious, but is also a well-tried and now largely-used machine. The attempt to obtain a steady rotary motion from a series of either regularly or irregularly fired explosions—irregular in point of time—and to do this also in accordance with scientific principle is no easy task; but here it has been accomplished.

The main characteristic of the engine is the "free piston;" the piston when impelled by the explosion rises freely upwards, without at that moment actuating the machine, the motive power being obtained indirectly during the descent by atmospheric pressure acting on the upper side of the piston, there being a partially vacuum condition below it, following the explosion. In the other type of gas-engines, on the contrary, the force of explosion is employed as the motive power, acting directly on the piston. Upon this principle were the two principal gas-engines known in this country previously to 1868, when the Otto add Langen engine appeared—namely, the horizontal gas-engines of French design—which were introduced a couple of years before. They were both partially successful at the outset, but owing to the numerous defects they never came into much use in the country. They were both very similar in appearance to the ordinary horizontal steam-engine, and the principal difference between them was that the explosive charge was fired in the one engine by electricity, and in the other by an arrangement of gas-lights. A further difference was added to this when the inventor introduced a jet of spray or water into the cylinder, which was evaporated there by the heat generated by the explosion, and somewhat aided in propelling the piston.

The principle in both these gas engines was, however, entirely wrong in the writer's opinion, for the following reason:

In them the explosion delivers its force against a piston connected to a crank and fly-wheel exactly as is done by steam in a steam-engine; but therein lies the evil. Steam gives a steady and sustained thrust to the piston, and the gradual motion of the piston is suited to it; but it is quite otherwise with an explosion, as in that case the stress is intense, but instantaneous only. The effect of delivering this sudden blow against a piston, connected rigidly with a heavy fly-wheel, is simply that instead of the heat, set at liberty by the union of the oxygen and hydrogen in the explosion, being converted into mechanical motion it remains in the form of heat, and has to be got rid of by a very large external supply of cold water, lest it should destroy the surfaces of the cylinder and piston, and even lead—as it has often done—to the buckling of the piston-rod when it has grown red hot.



In consequence, the common steam-engine pistons of the horizontal gas-engines, with their connecting-rods and cranks, will not, under any circumstances conceivable to the writer, enable them economically to utilize the suddenly generated and suddenly expiring force of an explosion. The blow given to the piston by the explosion is received by the heavy mass of the necessarily heavy fly-wheel, which cannot rapidly yield to it; and just as when a cannon-ball strikes a massive target which it cannot carry along with it, a flash of fire is the result in which the energy of the shot disappears, so in these engines heat instead of motion is the result of the release of the stored energies of the gases, and in this case heat is not what is wanted.

The flame of carburetted hydrogen, when the combustion is perfect, is intensely hot, and when repeated discharges take place—say 150 a minute, as in the case of the horizontal gas-engines—it is easy to see how much cold water must be circulated through the jacket of the cylinder to keep the temperature down to something below that at which oil oxidizes, in order to prevent the destruction of the piston. It is possible, however, to keep the temperature sufficiently low even in these engines by supplying enough water, but it takes a great deal; and where constant working is required adds much to the cost of running, and all the heat taken up by the water is carried off without doing work.

There is yet another element of difficulty connected with the horizontal gas-engines, and that is the deposit left by the gas after explosion. In both engines the cylinders are very much smaller, say less than one fourth the volume of the Otto and Langen engine for the same power. This is in their favor in cost of construction, but it is a drawback in working.

The difference in consumption of gas for the same power is found to be about as 1 to 6 in favor of the Otto and Langen engine, and as the cylinder in which this is burnt is also about 4 to 1 in volume, there is 24 times the space per unit of gas consumed in the Otto and Langen engine relatively to the others. This leads to a less liability to clog from deposit, and to become equally dirty the engine would require 24 times as many hours work. There have been, however, some favorable reports of a horizontal engine in this particular, and the quality of the gas may perhaps often be such as to cause no difficulty from deposit even in the two engines already referred to, though when the gas is dirty it is obvious the other has the advantage.

Some of the disadvantages accruing from using a common steam-engine as a gas-engine have now been shown, and this is practically what is done in the horizontal French engines, excepting, of course, the arrangements made for the firing of the charge and supply of the gas and air, in place of the valve for the passage of the steam.

It has been pointed out that great waste of fuel, great generation of heat as a necessary consequence, a large supply of cold water as a further necessary consequence, and sometimes, if not often, a heavy deposit of carbon and tar in the cylinder and pass-

ages, are the results obtainedfrom this principle of gas engine.

In the Otto and Langen engine, the idea of a "free piston" involves great constructive difficulty. The engine is really a gun, which stands vertically, with open mouth pointing upwards; the explosive compound of gas and air takes the place of powder, and the piston represents the shot. The charge measured off is, however, not sufficient to drive the shot or piston out of the gun, but only to within an inch or two of its mouth. The engine is single-acting, the upper side of the piston being continuously exposed to the pressure of the atmosphere through the open mouth of the cylinder, and this arrangement greatly aids in keeping the cylinder cool.

The piston-rod is a rack, and it gears into a toothed wheel on the main shaft of the engine, which is mounted on the top of the cylinder. The length of the rack is about equal to twice the circumference of the wheel, so that the single-acting character of the engine is very different in its effect from what it would be in a steam-engine. The toothed wheel referred to is, however, not keyed fast upon the shaft, but it is attached to it by a clutch, which permits the piston and rack to rise without moving the shaft at all, and connects them on the down stroke only. Thus the shock of the explosion is not sustained by the shaft, and the piston is able freely to move away from it, being arrested only by the resistance of the atmosphere at the end of the stroke.

The following is the series of operations in each stroke, commencing with the piston at the bottom:

First—the piston is lifted through a space of about 1-11th of the length of stroke, in order to draw in the charge of gas and air, and the power to effect this movement is obtained from the momentum of the fly-wheel. The charge is then fired by contact with a gaslight, and the piston flies up freely to the top. As it ascends, the plenum caused by the explosion is changed to a partial vacuum, which reaches to about 22 inches of mercury at the top of the stroke, and thus the motion of the piston is quickly reversed, and the down-stroke is performed under a pressure of about 11 pounds per inch derived from the atmosphere, and this driving power is communicated through the rack and wheel to the shaft. When the piston has reached within a short distance of the bottom, the vacuum, which has been gradually decreasing is again exchanged for a plenum, and the weight of the piston and rack expel the burnt gases during these last few inches of the stroke, thus completing the circle of the operations.

The mechanism used to connect and disconnect the piston rod rack with the shaft consists of a pulley, which is keyed to the shaft, and surrounded by a ring, on the interior of which are cut a number of inclined surfaces. On each of these inclined surfaces a set of live rollers is free to travel, and to press against a corresponding curved wedge while the piston is descending, and at the same time the opposite side of the wedge, which is faced with leather, presses against the pulley. It will be seen that while the piston is ascending no pressure is put on these wedges by the ring, and hence the ring can freely revolve upon its bearings on the shaft; but as soon as the down-stroke commences, a firm hold of the shaft is immediately gained by the ring, and the shaft becomes directly connected to the wheel which gears with the rack.

As by this means the piston is free to take any length of stroke within the limit of the cylinder, it is impossible to determine exactly at what moment it shall reach the bottom; and as the apparatus for lifting it to draw in the next charge is not required to move until the return of the piston, an intermittent motion is provided for lifting the piston, which is started at the right moment by a tappet fixed to the rack.

The mechanism consists of a pair of eccentrics, one of which moves a lever, which lifts the piston by means of a tappet projecting on the side of the rack; and the other eccentric moves the valve of the engine. These eccentrics are placed on an independent shaft driven by spur-wheels from the main shaft of the engine, and are started and stopped by an arrangement of ratchet-wheel and catch. The catch or pawl is made with a projecting tail opposite to the hook, and a stop is arranged to strike the tail of the pawl at a fixed point of its revolution, thus arresting it by throwing it out of gear with the ratchet-wheel. The pin of the pawl is carried by the eccentrics, so that when it is in gear it carries these round with it, and when out of gear all stop together. The stop for disconnecting the pawl is held in position by a spring, but when the rack descends to the bottom, the tappet on the rack moves the stop out of the way and allows the pawl to fall into gear. A revolution of the eccentrics now takes place, and when complete the stop arrests them until the next descent of the piston again effects their release.

But while the piston is lifted to draw in the charge, it is necessary to give the valve the power of both admitting the explosive mixture of gas and air, and also applying the light to fire it when received by the cylinder. The valve for this purpose consists of a flat plate, which moves between two faces attached to the cylinder base, the outer face being a movable plate kept up to its place by springs. The valve is provided with ports, adjusted for proportioning the gas to the air so as to form the required compound; and it is further fitted with a small chamber, with an opening both to the outside and to the inside, into which is carried an independent gas-pipe, so that a light may burn in this chamber Whilst the valve is at rest during the down-stroke of the piston, the opening on the outside of the valve is exposed to the atmosphere, and close to it burns a small gaslight, by which the gas fed to the chamber is ignited; but on motion being given to the valve, communication of the chamber with the outside is cut off, and is opened with the inside of the cylinder, and the flame that remains in the chamber explodes the charge. This is not effected until the gas and air supply are also cut off by the same movement of the valve.

The release of the exhaust or burnt gases is effected by the valve being provided with an independent port, which is open while the valve is at rest awaiting the descent of the piston, and so permits the escape to take place as soon as the vacuum has changed to a plenum.

It is necessary, however, to provide a clack-valve in the exhaust-pipe, closing inwards, as otherwise the atmosphere would enter the cylinder and destroy the vacuum, the exhaust port being open during the entire down-stroke; and this leads to an interesting point in the action of the engine. It is clear that another explosion cannot take place until the piston has arrived at the bottom and given motion to the eccentrics, and so shifted the valve; but the piston cannot get to the bottom until the escape of the burnt gases is effected, and, therefore, by simply preventing this escape, the interval between the explosions may be indefinitely prolonged, and thus the power and speed of the engine is controlled. This is done by arranging a common governor to press upon the clack-valve in the exhaust-pipe, and so delay the escape of the gases. This is one of the most important features of the engine, and is the invention of Mr. Otto; but perfect as the above method of governing the engine is in principle, it was found in practice to present a drawback. When the piston became leaky through wear, the exhaust was not obliged to escape only through the clack-valve, and thus, by going out another way, evaded the action of the governor, and so "running away" of the engine was possible.

The necessity for something better has now led to great improvement in this detail. Instead of preventing the piston from descending by closing the clack-valve, it is now allowed to descend, but its descent is not allowed to release the pawl that puts the eccentrics in gear and moves the valve, unless the governor also permits it. The governor now controls a second stop, which keeps the pawl from falling into gear and moving the eccentrics, not only until after the piston has descended, but until the speed of the engine has dropped to the desired limit.

There are points of comparison between this gas-engine and a steam-engine in which the latter has the advantage. A steam-engine does not necessarily make a noise in working, and the noise has hitherto proved to some extent an insurmountable difficulty with these gas-engines, on account of the rapid and intermittent character of their movements; but, on the other hand, it is a very beautiful and advantageous feature in these gas engines that the governor is able, as described, to stop all motion of the parts except the fly-wheel and shaft as soon as the work is thrown off, or less than full work is required. Instead of—as with steam—having the piston rushing to and fro while no useful duty is being done, it is here at perfect rest, and there is consequently economy both in fuel and wear and tear, as compared with steam. It has other advantages, in the power of starting at a moment's notice, and starting too at full power; in the fact that while the engine is standing no fuel at all is burnt: in the very trifling attendance required—very much less than with steam. There is no trouble with coals and ashes, nor in many cases is any water consumed. The engine not having any boiler, no boiler explosion can take place, and thus insurances are not affected by its use, or are only very rarely affected. Lastly, the economy of fuel is perhaps the most important difference. Where gas can be had at low rates, the 1-horse power engine will often run for 2s. 6d. or 3s. per week; it has not been known to exceed an average cost of one penny per horse power per hour, with gas at 4s. per 1000 feet, and it is generally much below this consumption, though no doubt not exerting its full power continuously.

Though one penny cost of gas per horse power per hour will not appear an economical consumption when compared with the value of say two pounds of coal per horse power per hour, there are several points to be borne in mind in the comparison. The above comparison has been made between the best and largest steam-engines and the gas-engine, but its practical opponents are the smallest and least perfect ones, in which the fuel burnt will probably be 15 or even 30 pounds of coal per indicated horse power per hour. Also gas compared with coal is, of course, greatly more expensive in cost per heat unit. Taking all into considcration, the commercial side of the question is entirely in favor of the gas-engine in the matter of economy of fuel. Taking the fuel lost in raising steam, and while a steam-engine is standing, and the cost while running all into account, the gas-engines have sometimes saved upwards of 10s. per week in fuel alone where they have replaced small steam engines, besides the saving in attendance, which is often considerably more.

But the most interesting question is the consideration of the engine from a purely scientific point of view. How many foot pounds are obtained on the brake per heat unit supplied by the fuel? Here the best steam-engines are surpassed by this gas-engine. Were pure hydrogen the fuel instead of adulterated coal gas, no less than two-fifths of the theoretic efficiency of the fuel might be realized on the brake; coal-gas, however, is less productive. Taking the proportion of gas to air for complete combustion as 1 volume of gas to 6½ volumes of air, and the theoretic efficiency of the gas as equal to 24,113 heat units per pound weight consumed, one heat unit being equal to 772 foot pounds, and taking the density of the gas as 40 per cent. that of air, or one cubic foot of gas = 0·0305 pound in weight, then the heat units supplied to the engine per minute are 595,686, and the return for this on the brake is, say, 70,000 foot pounds, or 12 per cent. To compare this with the best steam-engine, allowing for air-pumps and feed-pumps and friction, is it not even too much to say that 2 pounds of coal will give, under the most favorable conditions of a trial trip, 1-horse power per hour on the brake? Taking it at that figure, and taking the 1 pound of coal to supply 15,224 heat units, or 11,752,928 foot pounds, then $\frac{33{,}000 \times 60}{2} = 990{,}000$, or but 8½ per cent. of the theoretic efficiency of the fuel, while the gas-engine realizes 12 per cent., or nearly one and half times the amount.—*Journal of Gas-Lighting.*

The British Scientific Association.

The forty-fifth annual meeting of the British Association for the Advancement of Science has just been held in Bristol, and was, as usual, attended by some of the most eminent scientific men of the age. The president for the year is Sir John Hawkshaw, a civil engineer of universal repute. In his inaugural address he traced the progess of engineering from ancient to modern times, giving special prominence to a few of the more remarkable achievements which have been attained by scientific and mechanical skill. A few extracts from this profoundly learned and able address will prove both instructive and attractive.

ON THE SUBJECT OF METALLURGY

Sir John instructively remarks—

It has sometimes been questioned whether the Egyptians had a knowledge of steel. It seems unreasonable to deny them this knowledge. Iron was known at the earliest times of which we have any record. It is often mentioned in the Bible and in Homer; it is shown in the early paintings on the walls of the tombs at Thebes, where butchers are represented as sharpening their knives on pieces of metal colored blue, which were most probably pieces of steel. Iron has been found in quantity in the ruined palaces of Assyria; and in the inscriptions of that country fetters are spoken of as having been made of iron, which is also so mentioned in connection with other metals as to lead to the supposition that it was regarded as a base and common metal. Moreover, in the Great Pyramid a piece of iron was found in a place where it must have lain for 5000 years. The tendency of iron to oxidise must render its preservation for any long period rare and exceptional. The quality of iron which is now made by the native races of Africa and India is known as wrought iron; in ancient times, Dr. Percy says the iron which was made was always wrought iron. It is very nearly pure iron, and a very small addition of carbon would convert it into steel. Dr. Percy says the extraction of good malleable iron directly from the ore "requires a degree of skill very far inferior to that which is implied in the manufacture of bronze." And there is no great secret in making steel; the natives of India now make excellent steel in the most primitive way, which they have practised from time immemorial. The supply of iron in India as early as the fourth and fifth centuries seems to have been unlimited. The iron pillar of Delhi is a remarkable work for such an early period. It is a single piece of wrought iron 50 feet in length, and it weighs not less than 17 tons. How the Indians forged this large mass of iron and other heavy pieces which their distrust of the arch led them to use in the construction of roofs, we do not know. In the temples of Orissa iron was used in large masses as beams or girders in roof-work in the thirteenth century. The art of extracting metals from the ore was practiced at a very early date in this country. The existence long ago of tin mines in Cornwall, which are so often spoken of by classical writers, is well-known to all. That iron was also extracted from the ore by the ancient Britons is most probable, as it was largely used for many purposes by them before the Roman conquest. The Romans worked iron extensively in the Weald of Kent, as we assume from the large heaps of slag containing Roman coins which still remain there. The Romans always availed themselves of the mineral wealth of the countries which they conquered, and their mining operations were often carried out on the largest scale, as in Spain for instance, where as many as forty thousand miners were regularly employed in the mines at New Carthage. Coal, which was used for ordinary purposes in England as early as the ninth century, does not appear to have been largely used for iron-smelting until the eighteenth century, though a patent was granted for smelting iron with coal in the year 1611. The use of charcoal for that purpose was not given up until the beginning of this century, since which period an enormous increase in the mining and metallurgical industries has taken place; the quantity of coal raised in the United Kingdom in 1873 having amounted to 127 million tons, and the quantity of pig-iron to upwards of 6½ million tons.

THE STEAM ENGINE

is thus adverted to by Sir John Hawkshaw—

It was not until the steam-engine, improved and almost created by the illustrious Watt, became such a potent instrument, that engineering works to the extent they have since been carried out became possible or necessary. It gave mankind no new faculty, but it at once set his other faculties on an eminence, from which the extent of his future operations became almost unlimited. Water-mills, wind-mills, and horse-machines were in most cases superseded. Deep mines, before only accessible by adits and water-levels, could at once be reached with ease and economy. Lakes and fens which, but for the steam-engine, would have been left untouched, were drained and cultivated. The slow and laborious toil of hands and fingers, bone and sinew, was turned to other employments, where, aided by ingenious mechanical contrivances, the produce of one pair of hands was multiplied a thousand-fold, and their cunning extended until results marvellous, if you consider them, were attained. Since the time of Watt the steam-engine has exerted a power, made conquests, and increased and multiplied the material interests of this globe to an extent which it is scarcely possible to realise. But while Watt has gained a world-wide, well-earned fame, the names of those men who have provided the machines to utilise the energies of the steam-engine are too often forgotten. Of their inventions the majority of mankind know little. They worked silently at home, in the mill, or in the factory, observed by few. Indeed, in most cases, these silent workers had no wish to expose their work to public gaze. Were it not so, the factory and the mill are not places where people go to take the air. How long in the silent night the inventors of these machines sat and pondered; how often had they cast aside some long-sought mechanical movement to seek another and a better arrangement of parts, none but themselves could ever know. They were unseen workers, who succeeded by rare genius, long patience, and indomitable perseverance.

The only other extract our space will permit us to make is pertinent and approriate—

THE ECONOMY OF FUEL.

A pressing subject of the present time is the economy of fuel. Members of the British Association have not neglected this momentous question. At the meeting held at Newcastle-on-Tyne in 1863, Sir W. Armstrong sounded an alarm as to the proximate exhaustion of our coal-fields. Mr. Bramwell, when presiding over the Mechanical Section at Brighton, drew attention to the waste of fuel. Dr. Siemens, in an able lecture he delivered by request of the Association to the operative classes at the meeting at Bradford, pointed out the waste of fuel in special branches of the iron trade, to which he has devoted so much attention. He showed on that occasion that, in the ordinary reheating furnace, the coal consumed did not produce the twentieth part of its theoretical effect, and in melting steel in pots in the ordinary way not more than one-seventieth part; in melting one ton of steel in pots about 2½ tons of coke being consumed. Dr. Siemens further stated that, in his regenerative gas furnace, one ton of steel was melted with 12 cwt. of small coal. Mr. Lowthian Bell, who combines chemical knowledge with the practical experience of an ironmaster, in his presidential address to the members of the Iron and Steel Institute in 1873, stated that, with the perfect mode of withdrawing and utilising the gases and the improvement in the furnaces adopted in the Cleveland district, the present make of pig-iron in Cleveland is produced with 3½ millions of tons of coal less than would have been needed fifteen years ago, this being an equivalent to a saving of 45 per cent. of the quantity formerly used. He shows by figures, with which he has favored me, that the calorific power of the waste gases from the furnaces is sufficient for raising all the steam and heating all the air the furnaces require. It has already been stated that by working steam more expansively, either in double or single engines, the consumption of fuel in improved modern engines compared with the older forms may be reduced to one-third. All these reductions still fall far short of the theoretical effect of fuel which may never be reached Mr. Lowthian Bell's figures go to show that in the interior of the blast furnace, as improved in Cleveland, there is not much more to be done in reducing the consumption of fuel; but much has already been done, and could the reductions now attainable, and all the information already acquired be universally applied, the saving in fuel would be enormous. How many open blast furnaces still belch forth flame, and gas, and smoke, as uselessly, and with nearly as much mischief to the surrounding neighborhood, as the fires of Etna or Vesuvius? How many of the older and more extravagant forms of steam-engine still exist? What is to be done with the intractable householder, with the domestic hearth, where, without going to German stoves, but by using Galton's grates and other improvements, everything necessary both for comfort and convenience could be as well attained with a much smaller consumption of coal? If I have pointed out that we do not avail ourselves of more than a fractional part of the useful effects of fuel, it is not that I expect we shall all at once mend our ways in this respect. Many cases of waste arise from the existence of old and obsolete machines, of bad forms of furnaces, of wasteful grates, existing in most dwelling-houses; and these are not to be remedied at once, for not everyone can afford, however desirable it might be, to cast away the old and adopt the new. In looking uneasily to the future supply and cost of fuel, it is, however, something to know what may be done even with the application of our present knowledge; and could we apply it universally to-day, all that is necessary for comfort and trade could probably be as well-provided for by one-half the present consumption of fuel; and it behooves those who are beginning to build new mills, new furnaces, new steamboats, or new houses, to act as though the price of coal which obtained two years ago had been the normal and not the abnormal price.

The Pelouze and Audouin Condenser.

[From Le Gaz.]

Having been invited by Messrs. Pelouze & Audouin to examine their apparatus at the St. Maude station, we availed ourselves of the kindness, and would give the following account of what we saw.

The large condenser, of a capacity of 3,500,000 cubic feet per day, was dismounted; for the value of the invention is so completely recognized by the company that two, instead of one, are being erected at St. Maude, beside those ordered for other stations; and to put these two in place it was found necessary to shift the position of the first of them.

Our observations were therefore limited to the little experimental apparatus which had served to guide the studies of these gentlemen, and which in spite of its small dimensions was equal to the treatment of over 100,000 cubic feet per day.

The apparatus is composed of two glass vessels, the upper one of which, containing the condensing plates, receives the gas directly from the hydraulic main by one pipe, and delivers it through another, on which is placed a Beale Exhauster driven by a little steam engine. The lower vessel, serves to collect and discharge the condensed liquids.

The condenser, then, is placed before the exhauster, and it is consequently by the vacuum produced by the exhauster that the gas is caused to traverse the apparatus.

When this vacuum reaches the necessary point, it is most interesting to see with what alacrity the tar and ammoniacal liquor desert the gas; we see by the sort of bubbling which occurs at the countless orifices in the plates that the gas is tearing itself loose from the tarry and watery particles which were entangled with it at the outlet of the hydraulic main—the tar drops freely, while the globules of ammoniacal liquor

burst and sparkle so to speak, and splash against the sides of the glass case which contains the condenser proper.

The efficiency of the system is thus demonstrated, where an exhauster is employed.

Now it was the question of using the machine without an exhauster which induced our visit, and it was precisely this which could not be determined in our presence, the arrangement of the works not enabling us to apply the proof we desired.

We are then reduced to conjecture, but shall not be long in doubt on this point; as the company is about to erect a condenser at the St. Denis station, where no exhauster is used, which done, practical experience will determine the issue.

To the objections which, in default of conclusive experiment, we advanced, the inventors reasonably replied that as their apparatus stripped the gas of all condensable matter before reaching the purifiers, these last absorbed correspondingly less pressure than before, since the lime is no longer saturated with tar; that thence the insertion of their apparatus cannot add to the pressure of the works; that the condenser, to work thoroughly, does not imply that the gas be projected *with great force* through the apertures of one plate against the blanks of the next. It only requires, they added, that the pressure be slightly increased, and that the first foot or so of gas leaving the first group of holes shall have sufficiently moistened the blanks of the next plate by crushing the envelopes of the vesicles against opposed surfaces, these last being in this way rendered moist, and kept moist by the mere passage of the gas.

They also called our attention to the facts that the gas passes their apparatus at a high temperature, and that, as condensation occurs at this temperature, the subsequent cooling is much easier to effect after we have eliminated the tar and water which carry so much heat with them.

[From the same paper.]

We are indebted to the kindness of Mr. Brouse, manager of the Saint Germain Gas Works, for the following details of the performance of the Pelouze & Audouin condenser, since its adoption at that station.

In describing our visit to Pecq about two months since, we informed our readers that the immediate effect of the new condenser was to reduce the deposits of tar and gas liquor in the purifiers so completely, that instead of having to draw off from 40 to 50 gallons of condensed liquids per day, only about a pint of ammoniacal liquor was found.

We further observed that the use of the new condenser increased the back-pressure about 12-10ths of an inch, and we expressed the opinion that this figure could be reduced, or compensated in great part by the more normal state of the purifying material, deprived as this last must be of what moisture or tendency to cake is usually due to aqueous matter in the gas. In this we were not disappointed, and the results of actual practice have completely justified our expectation.

It is now established by an experience of two months that the working pressure of the condenser can be reduced to 10 or even 8-10ths (the latter being the lowest figure at which the condensation of tarry and watery matter is complete) and that after a few days' working, all moisture disappears from the boxes, and the pressure required to work the condenser being equalized, the gas passes through the lime with less back-pressure than before.

The Saint Germain gas works, as a whole, now run at precisely the same pressure as before the erection of the Pelouze condenser; the gas still traverses the scrubber, but leaves no deposit therein, so that this apparatus becomes useless; the cooler, which previously had its box flooded and its ducts sometimes choked, remains perfectly dry; the purifiers are freed from all deposit, and purification costs one-half less than heretofore, as the lime acts with almost theoretical energy.

Thus, to the great advantage of gas making, is solved a problem regarding which we have expressed some doubt; whether, namely, the Pelouze & Audouin condenser can be profitably employed in works which have no exhauster. Were we not warranted in saying last month that the apparatus was a success?

We cannot close this article without thanking Mr. Brousse for the courtesy which has placed the foregoing data at our disposal. We must equally congratulate him on having been the first, by happy intuition of the merits of the new condenser, to adopt it in works which have no exhauster; and this with a promptness which at once decides the whole industry of gas-making in regard to one very important point.

The Chemical Firefly.

BY PROFESSOR C. W. WRIGHT.

Of all the elements, there is none which presents such a diversity of forms as phosphorus, and not one that presents such a variety of properties which are so apparently contradictory. The number of allotropic forms assumed by this element, and the peculiar part which it plays in the conditions essential to the manifestation of sensation and intelligence, together with the fatal effects which often result from its introduction into the system, give it an interest not exceeded by that of any other form of matter whatever. A distinguished professor of this city, who was in his day a most attractive teacher, maintained that the chief element of success in a lecturer consisted in the power to address the eye, experimentally when possible, and by a well-drawn mental image when the subject under discussion did not admit of physical demonstration. In other words, he contended that nothing should be left to the imagination of the student. There can be no doubt that a single, well-selected experiment, skilfully executed, is more instructive than an hour's talk without illustration. Phosphorus may be selected as a means of illustrating the two methods of presenting a subject. Thus, the average text book informs the reader that phosphorus is luminous in the dark, or, in other words, phosphoresces when exposed to the air; and this is about all that is stated in reference to a property of this element, which is the most important of any connected with it. Upon this property, or one closely allied to it, is the poisonous quality of this agent based. Destroy this power of phosphorescence, and this element is no longer a deadly poison, either when swallowed, or by the action upon the bones of the upper and lower jaw. The phosphorescence of this element is accompanied by the development of ozone, and any substance which has the power of destroying ozone will arrest the luminosity of phosphorus, and, what is of still greater importance, destroy its poisonous action. In fact, phosphorus is not of itself a poison, but the ozone which it has the power of developing out of the oxygen of the air is the sole cause of the fatal results which follow its introduction into the system. This I have repeatedly demonstrated by experiments on the lower animals; and in two cases of accidental poisoning in human beings, the same facts have been proven. This is a subject, however, that properly belongs to the medical profession, and I will simply state that ten or fifteen drops of spirits of turpentine, mixed with an ounce or two of sweet oil, or any liquid fat, will prove an efficient antidote to elementary phosphorus, or any substance, such as the tips of matches or certain rat poisons, with which it may be incorporated. Other volatile oils, such as sassasfras, may be employed when turpentine is not at hand. It is not every specimen of turpentine that will prove antidotal to phosphorus. Any substance that has the power to instantly destroy the luminosity of this body will prove effectual as an antidote; and the only assurance we have of the efficiency of any agent is to test it beforehand.

Phosphorus is, then, not of itself capable of producing inflamation of any tissues of the body; but ozone, which it has the power of evolving from the oxygen of the air, is the cause of all the local mischief which results from its contact with certain parts of the body. That this body may produce certain general effects when it finds its way into the circulation, we do not doubt, but these are distinct from its local action.

To prepare the chemical fire-fly, by which some of the most characteristic properties of phosphorus can be demonstrated, select a two ounce phial which has been well annealed, and introduce into it sweet or almond oil, till the bottom is covered to the depth of half an inch (lard will answer, if nothing better can be procured), and to this add fifteen or twenty grains of phosphorus, and then cork it loosely. After this place the phial in a pan of cold water, and set it on a stove or other warm surface till the prosphorus melts, then shake the phial till the oil has dissolved as much of it as it is capable of holding in solution. Three or four vigorous shakes in the course of ten minutes will answer. That quantity of oil will not dissolve the whole of the phophorus, which is not desirable. The cork must not be a closely fitting one, but must be forced into the phial so as to nearly prevent the escape of the oil when inverted. It is best to give the cork more of a conical shape than those in use by druggists. When experimenting, the phial must be warmed about as hot as the hand can bear, and slightly agitated or inverted, taking care, when doing this, to have the cork well secured; it may afterwards be loosened a little. When the cork is properly adjusted, which can be easily accomplished by a little practice, the whole interior will light up every few seconds, in rythmical succession, and continue to do so for hours, provided the proper temperature is maintained. At the conclusion of the experiment, the apparatus should be put away in a dark place, and a tightly fitting cork introduced into the phial. A number of these phials, properly adjusted in a darkened room at different points, and several set swinging by means of strings suspended from the ceiling, produce a singular and weird impression, that grows upon the beholder the longer the experiment is observed; and after a time it is difficult to divest oneself of the idea that the light is evolved by a living, moving creature.

For impressiveness, there is no experiment in chemistry that makes such an enduring image upon the observer. Of course every precaution should be taken to avoid breaking the apparatus or spilling the oil. No damage however need be apprehended, provided the directions are strictly followed. In experimenting with phosphorus, the inexperienced should always be provided with a large vessel of water in which a few drops of turpentine have been diffused. When burning phosphorus has been extinguished by this water, there is little or no danger of its re-ignition, which is very apt to occur when it is extinguished in the ordinary way. The phosphorescence of this element, when a solution of it is spilled upon any object, as well as its disagreeable odor, are instantly destroyed by a small quantity of turpentine suspended in the water.

Under no circumstances should children or careless persons be permitted to experiment with phosphorus; not that it is anything like as dangerous as coal oil, and many other articles handled daily, but there is no substance that so completely demoralizes the understanding, in case of an accident, as this.

The glow-worm may be imitated by transmitting bubbles of air through glass tubes containing phosphorized oil. In fact, there is no end to the number and variety of experiments that can be devised by a person of inventive genius.

The phosphorescence of the fire-fly and glow-worm is due to slow combustion or oxidation; and the phenomenon is arrested in them, as it is in phosphorus, by placing them in a negative gas, such as nitrogen for example. Phosphorescence is not always, however, the result of oxidation. This fact can be demonstrated by exposing the diamond to direct sunlight for a few minutes, and then transferring it to a darkened room, when it will emit a beautiful light for several seconds.

The phosphorescence of the fire-fly is not due to the slow combustion of phosphorus, nor is it an ama

tory display on the part of that insect. The species are perpetuated under different circumstances, and in the daytime. The fire-fly is a carnivorous insect, and the object of the illumination is to attract small insects, which are quickly devoured.

If the ear be placed near the vessel of phosphorized oil at the moment of illumination, a slight hissing noise will be perceived, produced by a sudden rush of air into the phial, in consequence of the partial exhalation (one-fifth) of the air in the phial, by the abstraction of oxygen, which unites with the phosphorus. This fact is instructive. It demonstrates to us in a striking manner that a vessel which may be impervious to a liquid may permit the entrance or exit of a gas or vapor; and it accounts for the decomposition of spirits, conserves, extracts, etc., that are put up in vessels that are supposed to be hermetically sealed, simply because they do not permit of the escape of their liquid contents.—*Sci. Am.*

Dephosphorization of Iron Ores.

The following process for effecting the dephosphorization of ores has been patented by its inventor, M. G. Velge, of Liege: When a substance containing phosphate of iron is fused with two or three times its weight of a mixture of carbonate of soda and potash, the phosphorus can be removed in the form of alkaline phosphate by washing. Although this process is applicable to the treatment of small quantities only, its principle is that upon which M. Velge bases his own. He found (1) that chloride of sodium can be substituted for these carbonates; (2) that it is sufficient to add to the ore a weight of this reagent only a trifle in excess of the phosphate contained in the substance—say 6 parts of salt to 5 of phosphate, or 1 lb. of salt to about 1-5th lb. of phosphorus; (3) when the mixture has been well made the ore should be fused, but kept for some time at a mere red heat. When the gases have all been given off, water slightly acidulated with hydrochloric acid is added, and the phosphate dissolves after a little time. At first he used to crush the ore and the salt together, but, beside the expense of the operation compared with the low cost of the matter operated on, the final result was unsatisfactory. The ore came out in powder, with which there was every chance of choking the blast He then proceeded to dry strongly, or slightly calcine, porous ores, adding to them a concentrated solution of sea salt. This solution was taken up very greedily by the roasted ores, some varieties absorbing as much as 40 per cent. of their weight. In this way all the molecules of phosphorus are brought into the presence of the salt. After calcination and successive washings the quantity of phosphorus held by the ore was reduced from 1·25 per cent. to less than 1·2000th. Practically, perhaps, so high a degree of perfection would hardly be arrived at, but it is contended by the inventor that the process itself is quite satisfactory. Four operations are involved in the dephosphorization:

(1) The dessication of the ore by waste heat or other suitable method. If there be much phosphorus to remove, it will be best only to use such ores as lose much water on drying. On the other hand, if the ores contain but little phosphorus, it will be useless to dry them.

(2) The absorption of a solution of salt, stronger or weaker, according to the proportion of phosphorus,

(3) *Calcining.*—In the ordinary way the gases of the blast furnace are available for calcining, and when this is the case, the calcining can be effected in a vertical oven, the gases being kindled from below. In the absence of such gases, a reverberatory furnace must be employed, for the calcining in a vertical furnace by admixture of coal has the effect of partly reducing and melting the ore, and thus rendering the washing almost impossible. Not only are the pores of the ore choked in part, but, in the case of silicious ores, the phosphate of soda is converted into silicate of sone. In making use of the blast furnace gases all the carbonic oxide is consumed before reaching the ore, and there is no sign of reduction, even at the brightest red heat.

(4) *Washing.*—The ore should be left for several days in vessels filled with water taking care to renew the water frequently, and to add at each renewal a small quantity of hydrochloric acid. The water by itself would have but a small effect upon the phosphate. It is of the greatest importance to conduct the washing with care, for the success of the operation depends upon it.

Chemical & Scientific Repertory.

It is said that a few drops of a solution of equal parts of gum camphor and ether, applied from time to time to an erysipelanous surface will in the majority of cases, effect a cure.

To Deodorize Cocoanut Oil.—Mix with 1·32 parts freshly prepared bone black and 1·32 parts calcined magnesia, digest for three days, shaking frequently let stand till clear and filter.

A writer in a Belgian journal says that he has successfully kept a marine aquarium for nearly ten years without renewing the sea water in it; all that he does being to add fresh water as the salt water evaporates, the same degree of saltness being invariably maintained.

Beautiful semi-transparent cases of fancy articles may be taken in a compound of two parts unbaked gypsum, one part bleached beeswax, and one part paraffine. This becomes plastic at 120°, and is quite tough.

Prof. Huxley sends to *Nature* some notes from the *Challenger* by Prof. Wyville Thompson, who says he has "every reason to believe, from a series of observations as yet very incomplete, which have been made with the tow-net at different depths, that Radiolarians exist at all depths in the water of the ocean, while Foraminifera are confined to a comparatively superficial belt."

New Process for Copper Engraving.—Bouquet de la Grye, of Paris, proposes to cover copper plate with a thin, strongly adherent coating of silver: the silver plate is then varnished with a colored resist, and the engraving traced with a dry point; the etching is then bitten in by perchloride of iron. In this way the aquafortis process is ameliorated, as the adherence of the silver renders the engraving as clean as the tracing itself; this is a defect for portraits, but essential for cards.

Baron v. Dembowski has found that the components of a new double star which he had discovered, and which appears to be identical with one observed by Sir John Smith in 1825, have greatly changed their position in the course of the fifty years which have elapsed. One star approached the other by some 30 minutes, and has at the same time receded by about the same amount from a more distant companion on the opposite side; so that the change would appear to be entirely in this star. Further observations of this interesting object are much to be wished for.

Currents of Air within Cyclones and Water-Spouts.—In a memoir on cyclones and water-spouts, Mouchez publishes some observations made by him while upon the ocean, and which, if correct, are quite important. According to him, at or near the surface of the ground the movement of air in the cyclone is always from below upward, while in whirlwinds the movement is, on the contrary, from above downward. In the former case the winds are winds of aspiration; in the latter the wind descends from the cloud in the form of a bag, or tube, which terminates in a point. He believes that water-spouts have no relation whatever to cyclones, having an opposite appearance and cause. In this opinion Renou also concurs.

The Chameleon.—M. Bert has recently made some curious observations on the chameleon, which apparently indicate a very unusual relation of the two halves of its nervous system. Having removed the right eye of one of these animals, he produced, by irritating it, a rapid change of color on the left side of the body. The right side was much longer in changing its color, and did not acquire the same tint. He subsequently removed the left eye, and found that then the change of color on irritation was regular and identical on the two sides. In another experiment, reports the *Lancet*, he found that one of these animals, the right cerebral hemisphere of which had been removed, used only the left paw. On the subsequent removal of the left hemisphere it presented very active and bilateral reflex movements.

Experiments with Electricity.—Cadogan Morgan, in 1785, was the first experimenter who produced the electrical light in the interior of solid bodies. He inserted two wires in wood, and caused the spark to pass between them. The wood was illuminated with blood-red or with yellow light, according as the depth at which the spark was produced was greater or less. Many of the readers of the *Press* have doubtless seen an egg or a series of eggs lighted up by being placed in the line of discharge of a Leyden jar. An ivory ball, an orange, or an apple may be illuminated in a similar way. According to Tyndall, a lemon is especially suited to this experiment, "flashing forth at every spark as a spheroid of brilliant golden light." The wire used for the discharge should be brought within about half an inch of each other inside the lemon.

Separation of Acetic and Formic Acids.—Hagar's method for the separation of acetic from formic, valerianic, carbolic, and other volatile acids, depends on the perfect volatility of acetate of ammonia at a temperature of 98° to 100° C. This method was employed in analyzing a distillate which contained the three acids above mentioned. It was first rendered slightly acid with caustic soda, evaporated to a small bulk, and placed in a retort with an equivalent quantity of ammonic sulphate and some free ammonia, and then distilled in a wster bath. The retort was immersed to about two-thirds its depth in the water bath. The distillation went on regularly and easily as long as any drops collected in the beak of the retort, and no special cooling was required for the receiver. The distillate contained, beside ammonia, all the acetic acid and only a trace of carbolic acid, but no formic acid.

Test for Mercurial Vapor.—M. Merget has discovered that by dissolving iridium, palladium, platinum, gold or silver in aqua regia, a reagent is obtained which is extremely sensitive to mercury, and which will, he believes, prove of great value in the solution of very many practical and theoretic problems. A paper impregnated with such a solution is marked with an indelible block immediately it is brought in contact with mercury or mercurial vapor, no matter how small the quantity or how low the temperature may be. As a practical result of this research, M. Merget, by means of these test papers, exhibits the presence of mercurial vapor in all the workshops and warehouses where this metal is used or stored. If a workman passes but one hour in such an atmosphere, his clothing, face, hair, and beard become impregnated with mercury. If he but touches one of the prepared papers, he testifies to the presence of the mercury by a well-defined black mark.

Toughening of Glass.—The toughening of glass by use of an oil bath concerning which, so much is being said in connection with the La Bastie process, seems to be nothing new after all. Messrs. Bakewell, Pears & Co., of Pittsburgh, annealed their table ware in 1822 by placing it in a kettle covered with fish oil. Fire was then started under the kettle and raised to the highest attainable point, and then allowed to cool gradually. The glassware was in this way toughened to a considerable degree.—*National Oil Journal.*

Mineral and Mechanical Record.

NEW SAFETY LAMP.—At a meeting of the North Staffordshire Mining Institute, recently held, a paper was read on "Landau's new Safety Lamp for use in Mines." The peculiarity of the lamp is that the admission of gas extinguishes the flame, and it cannot, under any circumstances, be exploded by the lamp. The whole of the air for feeding the flame has to pass through an air-chamber in a limited space at the bottom of the lamp, and as soon as the impure air, such as hydrogen, fills up to that limited space, then the passage for the oxygen, which is requisite to support combustion, is stopped, and consequently the light gets suffocated for want of air. Successful experiments were made to demonstrate this. It was claimed for the lamp that it could not be affected by the strongest current of pure air; but the experiments in this respect were not so successful. But while these latter experiments did not show that the Landau lamp was inferior to others, the former were regarded as evidence of superior construction.

DIAMONDS.—Diamonds in the State of Georgia is a new direction of thought and speculation. Dr. Stephenson, a thoroughly earnest and well-informed mineralogist, has published a little volume on the geology and mineralogy of Georgia, in which he gives his theory, and his reason for it, in this matter. He holds that the great belt of plutonic and metamorphic formation, extending in a diagonal line through Georgia, is full of outcroppings (five being designated) of itacolumite or elastic sandstone, the matrix of the diamond. In each of these ledges, Dr. Stephenson informs us, diamonds of greater or less value have been found. In Hall county, in the northern part of the State, is a belt about 30 miles wide, running diagonally north-east and southwest about 70 miles. Several gold washings are in that belt, and at every one of them, our author says, diamonds have been found, varying in size from two to six carats Many larger ones have been found, and some very large ones were found and lost through ignorance of their being diamonds, the fact being probable from descriptions. Dr. Stephenson, now a very old man, proves his sincerity by entering upon the search for the precious stones himself, with his available though small resources.

SOFT IRON.—M. Deprez states that soft iron, malleable iron and tempered steel give the same results to investigations for determining the rapidity of their magnetization and demagnetization. The duration of demagnetization is 0·00025, and of magnetization 0·00160 seconds, approximately. Grey cast iron gives still better results, the time of magnetization being reduced to 0 001 second. With this last metal, therefore, the highest possible rapidity in the transmission of signals may be attained. This is due, according to M. Deprez, to the molecular structure of the metal, and not the proportion of carbon contained.

RAISING COAL.—A novel method of raising coal has been tried for some time in the Creuzot mining district, in France. An air-tight tube is fitted from top to bottom within the shaft of the mine; in this tube a piston works; to this piston a cage is attached, in which the tubs of coal are placed, and the tube is further fitted with valves and doors for regulating the supply of air, and running the tubs in and out. Air being admitted beneath the piston, the latter ascends with the coal to the top, and at the same time more than 70,000 cubic feet of foul air is discharged from the mine, while a corresponding in-rush of fresh air enters from the surface down into the workings. The same apparatus which raises and lowers the tubs will also raise and lower the miners.

BRIGHTENING IRON.—A Bavarian serial contains a method of brightening iron recommended by Boden. The articles to be brightened are, when taken from the forge or the rolls, in the case of such articles as plates, wire, etc., placed in dilute sulphuric acid (1 to 20 cleansing the articles, which are then washed clean with water and dried with sawdust. They are then dipped for a second or so in nitrous acid, washed carefully, dried in sawdust, and rubbed clean. It is said that iron goods thus treated acquire a bright surface, having a white glance, without undergoing any of the usual polishing operations. This is a process that those interested can easily test for themselves, but care should be taken with the nitrous acid, not to inhale any of its fumes. Boden states that the action of the sulphuric acid is increased by the addition of a little carbolic acid; but it is difficult to see what effect this can have, and it may very well be dispensed with.

A NEW HEATER.—For more than a year past, says the Indianapolis *Sentinel*, Mr. Henry Stacy has been endeavoring to perfect plans by which coal tar, crude oils, etc., could be practically utilized for the purpose of making heat enough to melt iron of all descriptions, brass, generate steam, etc. One af these heaters was placed on a furnace at the Malleable Iron Works last week, where it required eight days and nights to anneal the iron with coal, but the heater did work better in six days and nights, consuming but two and a half barrels of tar, costing $1.50 per barrel. M. Stacy thinks he can run a locomotive a distance of 100 miles without a fireman at a cost of 50 cents. The cost of each heater is not to exceed $2 for each furnace. The tar, oil, etc., passes from the barrel, tank or reservoir through a small pipe, and is deposited in front of a steam and cold air injector that forces it into the furnace in the form of spray, making a perfect mass of flame, but no smoke or sparks.

Gas-Light Intelligence.

[With a view of making this department of the JOURNAL comprehensive and complete, we solicit from correspondents throughout the country, items of gas intelligence. Whatever is new or interesting will be acceptable. Meetings of gas companies; improvements in gas arrangements; accidents at gas works; presentations to gas people, etc., etc., all form subjects of interest, and are worthy of note. Send them promptly, that the JOURNAL may be enriched, and our readers benefitted by their insertion.—EDITOR.]

United States.

ALL THE TESTIMONY taken before the Superior Court of New York in relation to the Fayette Vapor Gas-light claim has been laid before the Grand Jury at Jersey City. Some of the men alleged to be inevolved in the concern now hold office in the Jersey City government, while another is an ex-Commissioner of the Board of Public Works.

THE NATIONAL TUBE WORKS CO. are now manufacturing two or three hundred gas tanks, seamless wrought iron, fourteen inches in diameter, for the Pennsylvania railroad, for carrying gas to light their passenger cars. These were formerly made of riveted sheet iron.

THE *Bulletin of the Iron and Stock Association* says: Upon application, we have received from the United States agents, Messrs. Richmond & Potts, of Philadelphia, the following statement of the number of Siemen's regenerative gas furnaces now in use in this country: "There are 32 crucible steel-melting furnaces in operation, capable of producing over 45,000 net tons of cast steel per annum, and 14 open-hearth furnaces, for the manufacture of steel by either the scrap or ore process, of a working capacity of 35,000 net tons per annum. Also, throughout the various iron and steel works of the country there are 56 of the Siemens gas heating furnaces in operation, capable of heating, on single turn, over 300,000 tons of iron and steel per year, of 270 working days. In addition to the above, there are in successful operation a number of single and double puddling furnaces, glass furnaces, etc., and there are in present course of construction 44 furnaces, to include crucible steel-smelting, open-hearth, heating and puddling furnaces. The furnaces which are enumerated above have, for the most part, been erected within the past year or eighteen months."

Great Britain.

In Great Britain there has lately been a tendency to considerable reductions in the price of gas. The primary cause of this is a reduction in the price of coal.

The Newcastle and Gateshead Co., which recently reduced the price from 4s. to 3s. 4d., have now resolved upon a further reduction to 3s., with 10 per cent discount for prompt payment as before. At Melton Mowbray the price will be reduced to 5s. at the end of the current quarter. At Sherbourne the price has been reduced from 5s. to 4s. 7d., and at Huntingdon and Gedmanchester there will be a reduction of 5d. from the 1st inst. The directors of the Cardiff Gas Co. have resolved to reduce the price to consumers in the town to 3s. 6d. per 1000 cubic feet, the reduction to take effect from the 30th of June last. The price at Reading was reduced 3d. from 1st of July.

The London Gas Co. have reduced the price for common gas to 3s. 9d. per 1000 cubic feet. The Ashford Co., Kent, has reduced from 5s. 5d. to 5s. The Wellingborough Co. from 5s. to 4s. 9d. At Wrexham the price has been reduced from 4s. 8d. to 4s. At Dysart, Scotland, from 9s. 3d. to 7s. 6d. per 1000 feet and so in like proportion a reduction has been made in most of the principal towns in this country.

The Sherborne Gas Co. shows a profit of £953, and has declared a dividend of eight per cent.

A Chelsea hotel proprietor has been committed for trial on a charge of stealing gas from the London Gas Light Company.

It is stated that the Public Works Committee of the Corporation of Dudley, intend to recommend to the council the purchase of the undertaking of the gas company supplying the town.

At a recent meeting of the Dundee Gas Commission the manager reported his make of gas, etc., for the month of June. The consumption of coal was 722 tons 10 cwt., and the gas produced amounted to 8,193,600 cubic feet.

The Lanark Gas Co., Scotland, has just declared a dividend of five per cent. to shareholders, and five per cent on £2,500 bonds, has set aside £200 for the depreciation of stock, and paid off an overdrawn account at the bank.

The corporation of Birmingham has taken over the works and business of the Birmingham Gas Co. A circular is now being issued to the shareholders in the company, offering them immediate payment in cash for their interest in the undertaking, or the choice of payment in debentures of the corporation.

The English *Gas-Lighting Journal* mentions as an instance of returning faith in gas property that the Dover Gas Company issued some new £10 shares last week, and inaccordance with the company's Act of Parliament they were put up to auction, and realized £15 5s. to £15 7s. 6d. per share.

At the half-yearly meeting of the Newport (Mon.) Gas Co., held on the 9th ult., the report showed that the works had proceeded satisfactorily, and that after defraying all expenses and paying the usual dividends there was a balance in hand of £263 6s.

The North British Railway Co. are the proprietors of the Burntisland Gas Works, Fife, Scotland. During the time of dear coals the price of gas was raised

from 6s. 8d. to 7s. 6d. per 1000 cubic feet. Coals having become cheap, it was officially announced that the price would be down to the old figure. Meantime, relations between the burgh and the company became unfriendly through the dock imbroglio. It is now officially intimated that the high price of gas is to be maintained. Consumers are resisting payment.

In a special report of the Halifax Gas Co. it is stated that the quantity of gas manufactured during the months of April, May, June, and July, this year, is 43,158,000 cubic feet, and the cost of production of same in wages, including an amount paid for cleaning and painting, amounts to £2,157 8s. 9d. The quarterly make in the corresponding months of last year was 40,356,000 cubic feet, and the cost £2,261 15s., being an increase in quantity of 2,822 cubic feet, and a decrease in cost of £104 6s. 3d.

Early on the morning of the 16th ult., an explosion occurred at the North Cambridgeshire Hospital. Some of the servants had detected an escape of gas in the matron's room, and the porter, Whittelsea, having stopped the leakage, struck a match. Immediately a terrible explosion took place. Whittelsea was badly burnt about the face and hands, and the under nurse also suffered severely. The housemaid, who was standing at an open window, was thrown out, but alighted without much injury on a flower-bed. None of the patients were hurt, but considerable damage was done to the doors and windows by breakage.

At the recent annual show of the Highland Society held in Glasgow, a new gas apparatus was exhibited, for diminishing the loss of life in mines from fire-damp explosions. Suitable safety lamps, placed wherever required in the mine, will be fed with gasolene gas from generators. By a most ingenious contrivance some, or all the lamps in the mine, can be instantly lighted up without the necessity of introducing fire into the mine, and as instantly extinguished without the lamps being opened; so that if the miners take no lucifers with them into the mine, and there is no blasting by gunpowder, no explosion and loss of life can take place in mines so lighted up.

The gas supplied to the Sculcoates and Myton district, Hull, by the British Gas Co. during July possessed satisfactory illuminating power: it was at all times free from sulphuretted hydrogen, or free ammonia by the ordinary tests. The results for the month are:

	Max.	Min.	Mean.
Illuminating power standard sperm candles	16.54	15·59	16·08
Grains of sulphur per 100 cubic feet	26·00	23·50	24·60
Grains of ammonia per 100 cubic feet	...	...	00·60

Mean barometer and temperature in experiment-room: Bar., 30·16; tem. 65°.

The Mechanical Production of Oxygen Gas.

According to Graham, the proportion of oxygen in atmospheric air can be increased by means of dialysis from the normal 21 per cent. to that of 42 per cent. By means of an air-pump atmospheric air is caused to traverse a kind of air cushion, whose inner wall is lined with flannel and a thin caoutchouc membrane. The oxygen passes though the membrane more rapidly than the nitrogen, and therefore the dialized gas becomes richer in oxygen. Graham assumes that the gas condenses on the surface of the membrane, being again vaporized as it reaches the other side.

The latest and most ingenious method, patented by Mallet, is founded, firstly, on the different solubilities of oxygen and nitrogen in water. One volume of water dissolves only 25·1000 nitrogen to 46.000 oxygen. When these gases are mixed, as, for instance, in atmospheric air, the respective solubilities remain the same but these must be multiplied by the tension of each gas in the mixture:

$$0{\cdot}79 \times 0{\cdot}025 = 0{\cdot}0197 = 0{\cdot}67$$
$$0{\cdot}21 \times 9{\cdot}046 = 0{\cdot}0097 = 0{\cdot}33$$

which is, in fact, the composition of atmospheric air dissolved in water, as determined by analysis. Secondly, it is based upon the fact that water holding atmospheric air in solution, when coming in contact with oxygen, parts with the absorbed nitrogen, and takes the oxygen in its place. If now, by means of a suitable apparatus, atmospheric air is forced into water, nitrogen and oxygen are dissolved in proportion of 67 to 33. This solution, by continued pressure upon the unabsorbed air will take still more oxygen from this and give nitrogen in exchange. Upon the removal of the unabsorbed gas, which is now rich in nitrogen, and the abatement of the pressure, the dissolved gas escapes from the water. By treating this six or eight times more in a similar manner, a gas containing 1·973 of oxygen can be obtained.

According to De Laire and Montmagnon, charcoal absorbs 985 times its volume of oxygen, and only 705 times its volume of nitrogen; and as it seems that the oxygen absorbed by freshly burnt sponge passes into the ozone form by reason of the traces of iodides and bromides present, these agents may become highly useful pulverulent oxygen-bearing vehicles.

Correspondence.

[Correspondents, in all cases, should sign their communications with their names and address in full—not necessarily for publication, but as a guarantee of good faith.—Ed.

Water Gas.

New York, September 9, 1875.

Mr. Edftor: In your issue of the 2d inst., under the above caption, you refer to the new gas company of Poughkeepsie, as "now making water-gas, with how much success we cannot say." Let me inform you that the Citizens Gas Company of Poughkeepsie are making their gas *solely under the Gwynne-Harris* or *American hydro-carb n process*, aod if you, or any gas company would like to see "how much success" has been the result of *two months* operation, a visit there will satisfy even the most sceptical. Especially let them ascertain the views of the people of that city, on the question of *light* and *cost*, as between the *new* and the *old* system. I think any gas company would feel better if, instead of complaints and curses, they could hear nothing but expressions of the utmost satisfaction from their consumers; both as to the quality of the light furnished, and the amount of the bills rendered. And this good feeling would not be lessened, when any such gas company found that they could *well afford* to give to their consumers such satisfaction.

The general rule in trade is well understood; that the poorer the quality of any article, the less the cost of it to the customer. And the people are beginning to understand the fact, that in respect to the immense gas business, this general rule is reversed; and that the *poorer the quality of the gas delivered*, the more it cosis the consumer per month or quarter. Under our process we can furnish not only a more beautiful and brilliant light *than can be made from coal*, but we can well afford to let our consumers realize the benefit arising to them from the use of a *less quantity* of gas than they would otherwise require of a poor article, to give the light they need.

You also mention a project "to bring into operation water-gas works on the Tessie du Motay system," and you give an extract of a description of Mr. Lowe's process in producing, from anthracite and the decomposition of steam, a gas of a very high heating power, and then enriching this by means of crude petroleum, and that "the anthracite is charged in a small cupola."

Before any one embarks largely in these projects, I would advise him to take special notice of the various letters patent owned by the National Coal Gas Company, commonly known as the *Gwynne-Harris patents*, which cover the only true method of making water-gas, at a minimum cost. *Infringements* will prove dangerous and expensive.

As to the Tessie du Matay patent, and Mr. Lowe's process for decomposing steam by means of a *cupola*, I will next say, that if any one will take the trouble to compare these late, so-called, improvements, with the letters patent of the United States, No. 40,925, granted to William H. Gwynne, December 15th, 1863, for the same purpose, by means of a *cupola*, it will, I think, appear very evident, that they are nothing but infringements. And although our progress and our improved patented apparatus are so far in advance of *any such cupola*, yet we want it to be understood that any infringemen t upon our rights will subject, *whoever is a party to such infringement*, to damages and costs.

The Citizens Gas Company of Poughkeepsie make water-gas, under our process, and then carburet it with *crude* petroleum (about 2½ gallons to 1000 cubic feet), which makes 16½ to 18 candle gas. They light all of the gas burning street lamps, and the public buildings, and a large portion of the city: and deliver already nearly 50,000 feet per day. The patented fire clay double retort (letters patent of the United States No. 112,593, granted to our engineer, Geo. W. Harris, March 14, 1871, and manufactured only for our process), proves to be the best and most reliable retort ever made.

H. P. Allen,
Pres't National Coal Gas Company,
No. 4 Warren street, N. Y.

British Gas Patents.

I. Mr. J. Somerville, Dublin, has taken out a patent for manufacturing gas for lighting and heating, and for apparatus used therein. These relate to carbonising coal or other material in large masses, the apparatus consisting of retorts made of fireclay or brick about 20 feet long, 10 feet high, and 28 inches high at bottom, but tapering to a foot wide at top, with doors to open both at bottom and top, those at the bottom being so constructed as to be entirely removable if necessary on a frame or wagon, constituted so as to receive the coke when the charge is withdrawn. The retorts or ovens are set side by side upon arches that will admit of wagons or trucks passing beneath the retorts. The furnaces are placed between the retorts, and are fed with fuel from the top, and the ashpit is made sloping so that clinker or ashes may slide down into a receiver, from which it may be removed from time to time. The fire bars are made with recesses for the insertion of firebrick, which may be removed when requiring renewal. The exit pipe for the gas is at the top of each retort, the pipe being led into a chamber which also contains one extremity of the pipe leading to the condensers. The passage from one pipe to the other is sealed by a diaphragm, which is placed between them and dips into water contained in the chamber. From the chamber just mentioned the gas passes into the condenser, consisting of a series of pipes. These pipes are connected at each end with a chamber, the gas being made to pass from chamber to chamber in a zigzag direction, together with the products of condensation, and at each chamber are received in bulk, and broken up into separate streams, and again collected in bulk until the end. The retorts are charged with coals from a wagon or wagons made to run along a tramway above them, and when charged, the lower doors being previously secured, the upper doors are closed and the coal left to distil, the gas passing off by the exit pipe to the condensers.

II. Another important patent for the manufacture of illuminated gas, and the apparatus employed therein, has been taken out by Mr. W. H. Beck, London, and is thus described: "They consist of (1) admitting steam or the gases resulting from its decomposition by the action of heated carbon or iron, into gas retorts heated to the ordinary gas working tempera-

☞ *For other reading matter see page* 110.

THE AMERICAN GAS-LIGHT JOURNAL AND CHEMICAL REPERTORY.
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(Immediately fronting the Ferry Houses.)

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LIGHT, HEAT, MINING INTERESTS, STEAM, WATER-SUPPLY, PATENTED INVENTIONS, VENTILATION, SANITARY IMPOVEMENT, AND GENERAL CHEMICAL SCIENCE.

TERMS

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☞ All communications to be addressed to **"The Proprietors,"** No. 42 Pine Street, Room 18, New York.

THURSDAY, SEPTEMBER 2, 1875.

WISHING TO MAKE THIS JOURNAL an organ of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, the publishers solicit letters from all among them who make the study of these subjects a pleasure, or a profession.

Subscribers would confer a favor upon us by remitting *CHECKS*, or *POST OFFICE MONEY ORDERS*, as we are frequent losers where money is enclosed in letters.

☞ NEWS AGENCY.—The American News Company, 11 and 121 Nassau street, New York agents for this Journal. News dealers will please send orders to them.

NOTICE.

☞ *All Collections for Advertisements, Subscriptions, etc., are made directly from this Office. We have Agents to solicit the same, but they are not authorized to Receipt for Money.*

TO OUR SUBSCRIBERS AND PATRONS.

In making remittances for subscriptions, always procure a draft on New York, or a POST OFFICE MONEY ORDER, if possible. Where neither of these can be procured, send the money, but always in a REGISTERED LETTER. The registration fee has been reduced to eight cents, and the registration system has been found by the postal authorities to be actually an absolute protection against losses by mail. ALL Postmasters are obliged to register letters whenever requested to do so.

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EDITORIAL GREETING.

The present number of the GAS-LIGHT JOURNAL is issued under new editorial management. A few changes have been made in the general arrangement and style; and these are but the precursors of other improvements by which it is intended to render the paper more thoroughly acceptable and useful.

As the organ of an important public profession, the JOURNAL will henceforth take a wider range, and a higher aim. Every subject falling legitimately within its province will be discussed, whilst every event appertaining to the manufacture of gas, and to the operations of gas-works, will be reported. In the selection of articles a wise discrimination will be exercised, that what is most appropriate may appear. The gas intelligence of the day will be collected, condensed, and classified with great care, so that no fact may be left unnoticed, and that the reader may at a bird's eye view gain an idea of all the principal gas events of the country and the world. In the treatment of primary and practical principles, of great discoveries, and useful inventions, the editor will bring to his aid men of profound learning and eminent scientific skill; while in the literary management of the paper judgment, experience, and taste will be combined to avoid error, and to ensure perfection. As a literary and scientific organ, the GAS-LIGHT JOURNAL may take rank with the first productions of the country; and our aim shall be so to manage it that it will become indispensable to every gas manufacturer, mechanic and artisan—in short, a credit to the profession.

It now remains to ask the hearty co-operation of our readers and friends. The success of a journal is primarily dependent upon the skill and management of the editor; it must be ultimately secured by the efforts of those who sympathise with him. There are many who cherish a warm interest in the GAS-LIGHT JOURNAL, and who have not been wanting in practical proof of their regard. The number of such must be largely increased. Without complaining of the past, we desire a larger circulation for the future. The JOURNAL must have power; and it will have this in proportion as it is circulated and read. It should be the companion of every gas-man in the country; and if the co-operation of our friends be commensurate with our own exertions, the present list of subscribers will shortly be more than doubled.

What then? Let every subscriber recommend it to his neighbor; and let there be from all parts of the land such an addition as will show that our efforts are appreciated, and that the gas-fraternity are resolved to sustain a journal worthy of the profession, and which shall aid in no small degree the advancement of Gas Science and its interests.

[CIRCULAR].

THE ANNUAL MEETING OF THE AMERICAN GAS-LIGHT ASSOCIATION.

It will be seen by referring to the advertising columns, that the next meeting of the American Gas-Light Association is to be held in the City of New York, on the 20th of next month (October.) Professor C. F. Chandler, of the Columbia College School of Mines, has consented to deliver an address before the Association, at one of the sessions during that meeting, which will be illustrated by experiments rarely seen by the general public, or even by the great body of gas manufacturers. These experiments will demonstrate to the members present some of the latent and hidden qualities of the materials which gas manufacturers deal with.

As the years roll on, the public, who are the patrons of the gas companies, become more and more exacting in this, that they demand better quality, by way of higher candle-power, for the same money, or a less price for that now furnished. This demand on the part of the consumers has, in England, Scotland and Ireland, become an earnest and serious matter; so much so that, in some places, fair rates of dividend are impaired, and in others entirely destroyed. To such proportions has this demand grown, and such vigor does the movement manifest, that the gas companies of London, acting in concert, with their immense capital and money influence, are not able to stem the current.

We may fairly expect the same mania to reach the gas-consuming public of this country, and that the same demands and exactions will sooner or later be made on the gas manufacturers here.

For some years past the Legislatures of several of the States have been importuned to pass laws against the interests of the gas companies, and supposed to be beneficial to the consumers. In many instances these efforts have resulted in the enactment of laws not of serious injury to the gas manufacturer. If the matter were to stop where it stands at present, none, or very little harm would be felt, and probably a benefit would result from past legislation; but the chances are that past legislation is but the flying scud before the storm.

It may be said that this is croaking—possibly it is. Prior to the year 1874 the legislation had been general in its character; but in the session of that year the New York Legislature passed a law which affected the gas company of the city of Poughkeepsie, and in the year 1875, another, affecting the city of Yonkers, both so arbitrary in their character as to endanger all gas property in the State of New York. These encroachments on gas interests are infectious, and will soon reach other States and be imitated there. At present these indications of danger are but the small cloud just above the horizon, a little larger than a man's hand; but who can tell how fast it may grow, or what particular company may next be hit?

Self-preservation requires that the gas companies should take counsel together on this subject of unfriendly legislation; and how better can they do it than by united action in and through the American Gas-Light Association?

All interested in the subjects which must engage attention, should endeavor to attend the annual meeting, and thus contribute their share towards its success.

CHAS. NETTLETON, Secy. and Treas.

LIGHT AND VENTILATION.

Two grave defects have been discovered in the arrangements of the new Post Office in this city. With all the money expended, and all the talent employed, it was naturally assumed that the building would be perfect in both design and details. In two important matters, however, there appears to have been an oversight, or a want of judicious management. The arrangement for the gas-lighting of the general sorting room is said to be imperfect, so that the clerks employed therein are seriously inconvenienced in reading directions, and preparing for despatches; whilst in the general delivery department, and some of the lower rooms, the want of ventilation is such as to render them practically

unhealthy. Already the inconvenience has been severely felt; and it is not unlikely that a remedy for the evil will be applied, and that all ground of complaint will be removed. It may be cause for regret that any necessity exists for alteration; in attempting to repair such blunders an injury may be done to the harmony or beauty of the building; and what in the first instance could have been secured at small cost by timely forethought, may now involve great labor and expense.

It is at this point that the subject assumes a practical, no less than a professional aspect, the due consideration of which enters essentially into the province of this JOURNAL. The manufacture and supply of gas, of pure quality and abundant quantity, are not the sole objects in which we are interested, and to the promotion of which our efforts are directed; any more than it fulfils our purpose simply to say that through the wisdom and beneficence of the Great Architect fresh air and pure water are accessible to the inhabitants of the country and the town. What is needed in the latter case is that in the erection of houses, such arrangements may be made by pipes and windows, etc., that the one may be received, and the other inhaled, without being vitiated in its nature, or restricted in its supply. In the same manner a proper apparatus for the conveyance and regulation of gas is necessary. Without this the best supply in the world will be inoperative for illuminating purposes. The size, the construction, the ventilation of a building, all enter essentially into the question of the quantity of gas, and the arrangement of pipes required.

Yet neither light nor ventilation seems to be regarded by architects and builders in their preliminary estimates, as an indispensable requisite. Both are left too much to the "chapter of accidents," or to be arranged as, or by an "afterthought." The anxiety is to produce a beautiful building on cardboard, which, when practical details come to be worked out, is found radically defective in some of the most desirable (because useful) points. In matters which appertain to health, and business, and comfort, it is an extremely unwise thing to sacrifice utility for beauty; and of all questions which are urged upon public attention, none can be more important in a sanitary point of view than those of light and ventilation. Whether considered in their bearing upon private houses or public halls, upon street cars or railway carriages, they affect very materially both the health and comfort of the community. No plan, therefore, should be accepted for any building which does not duly provide for these; and in all cases where a mistake has been made in past arrangements, that mistake, if possible, should be repaired. It is surprising that by professional men so much indifference has been shown upon the subject; and it must now be regarded as a favorable sign that public attention is more repeatedly directed to it, and that the principles and laws of lighting and ventilating are being more thoroughly discussed, more clearly understood, and more practically exemplified. In the *Westminster Review*, Appleton's *Journal of Applied Sciences*, and other publications, special prominence has recently been given to this matter. The extraordinary oversight or blunder at the Post Office will aid in enforcing its necessity upon the public mind; and as forming part of our mission, we shall not fail to insist upon light and ventilation, upon purely scientific principles, as conducive to public health, and as one of the great requisites of the age.

WATER-GAS.

In another part of to-day's issue will be found a lengthy letter on the question of Water-Gas. The letter is worthy of attention alike from the nature of the subject, and from the position of its author. Whatever diversity of opinion may prevail among scientific men on some of the questions involved in the letter, no doubt can exist that a most useful experiment is being made by the Citizens Gas Company of Poughkeepsie; and in view of the facts stated by Mr. Allen, there can be as little doubt that the experiment has been so far attended with some success.

As an additional evidence of the advancement of science in its practical application, and as a further proof of improvement in the manufacture and supply of gas, the experiments at Poughkeepsie may stimulate further effort. Science is active and progressive; and on the questions touched upon in this letter there are yet brilliant achievements to be made.

NOTICE.

AMER. GAS-LIGHT ASSOCIATION

OFFICE AMERICAN GAS-LIGHT ASSOCIATION,
117 BROADWAY, N. Y. CITY.

THE THIRD ANNUAL MEETING OF THE ASSOCIATION will be held in the **CITY OF NEW YORK,** on the **26th of October, 1875,** for Election of Officers, and other business incident to the Annual meeting. All Members of the Association are earnestly requested to be present.

Every Gas Company is invited to become connected with the Association, by having one or more of its Officers, Engineers, or Superintendents, become a member.

Individual Managers of Gas Works, and all persons practically skilled in the Construction and Management of Gas Works are also invited to join the Association.

CHARLES NETTLETON, Secretary.

TO GAS COMPANIES, AND CITY GOVERNMENTS.

DYOTT'S PATENT

CHAMPION STREET LAMP

Doubles the Light with the same quantity of Gas used in other Lanterns. *All others* waste half their light, illuminating the sky, or if the top is of metal, absorb it.

SINGLE TOP GLASS LAMPS BOTH GLOBULAR AND SQUARE become heated if a good light is put in them, and rain, hail or snow falling upon the HEATED GLASS BREAKS IT. When one glass is broken the wind will either blow the flame against the others and break them, or destroy the entire Lamp. *Nine-tenths of the breakage and cost of repairs of other* street lamps is owing to that cause.

DYOTT'S "CHAMPION" is the only DOUBLE TOP—the only Lamp that has the Opaline White Dome, which is a *never changing reflector;* it doubles the power of, and throws the light to a greater distance. It is also a perfect *protector*, shielding the heated top or the lamp from all inclemency of the weather. The white dome is kept cool by the passage of air between it and the transparent globe below. Rain, hail or snow will never break either the globe or dome. The globe rests upon rubber cushions, and is supported laterally by elastic springs, so that contraction or expansion of the globe, or jarring of the post will not break it. They can be cleaned in one-fourth the time required to clean other lanterns. The metallic portions are of iron, copper and brass, and are the most durable, economical, efficient and cheapest lamps in existence. For public buildings, and wherever an ornamental and powerful light is required, they are made in CLUSTERS of 2, 3, 4, 6, 7 and 10 lamps, which have no equal in this or any other country for *beauty, durability, efficiency* and economy, either in cost, use or ornamentation. Designs furnished when requested for specific purposes. Gas companies, or those who have the lighting of Cities in charge, are solicited to communicate with us in reference to the agency for its introduction.

The Franklin Institute has awarded our CHAMPION LAMP the highest premium: (they give a silver medal) and its Committee on Science and the Arts has recommended it as the best lamp in use. It has also invariably taken the highest premium at every Exhibition at which it has been presented, and elicits the strongest commendations wherever it is used. We have several new and handsome patterns of POSTS for Corporations, Parks, public and private use, also for clusters of lamps, that are not excelled in beauty or price at which they are furnished.

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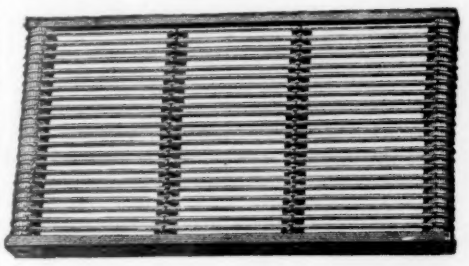

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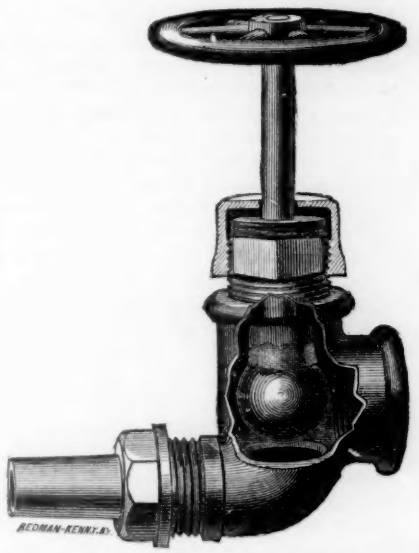
SOMETHING NEW.

THE HUMPHREYS VALVE.

FOR USE AT CONSUMER'S METERS.



This valve is made of malleable iron, and is specially adapted to encounter the heat of burning buildings, in which the ordinary meter cock (made of brass) will crumble or melt. It is opened or shut with ease, by sliding the stem up or down, the latter being held where desired by the friction of the packing. It is perfectly tight, and is not so liable to get out of order as the meter cock: its cost being about the same.

The great advantage of this valve is, that in case of fire—when the gas cannot be shut off by hand, the heat will automatically close the valve, and thereby stop the flow of gas. The certainty of its action in this way will be at once apparent when it is observed that the valve proper is a round iron ball, attached with a soft solder composition (melting at 250°) to the end of the stem, and held directly over the seat. The heat of the fire, melting the solder, releases the ball, which drops into the seat, and shuts off the gas.

Peference is made, by permission, to the following gentlemen, well-known to the gas fraternity—H. Q. Hawley, President Peoples Gas-Light Company, Albany, N. Y.; Isaac Battin, Engineer Albany Gas-Light Company, Albany, N. Y.; F. A. Sabbaton, Engineer Gas-Light Company, Troy, N. Y.; C. House, Proprietor Union Gas Works, Lansingburgh and Waterford.

Send for price list to WILLIAM HUMPHREYS, Waterford, N. Y.

ture, above the charge, the gases, vapor and steam being then conveyed through a decomposer filled with heated porous materials, by which means the tarry and other vapors are converted into a volume of permanent gas additional to that resulting in the first instance from the charge of carbonaceous materials in the retorts; (2)charging a mixture of tarry matter and small coal into retorts: (3) admitting steam, or the gases resulting from its decomposition, into such retorts, and passing the resulting gases, vapors and steam through a heated decomposer, in order to effect their conversion into permanent gas: (4) dropping tarry and other liquid products through upright heated pipes; (5) mixing the vapors so produced with steam or the gases resulting from its decomposition, and passing the mixture through a heated decomposer to complete the conversion of the permanent gas; (6) employing an inclined vaporing retort into which the tarry or other liquid products are introduced, and caused to flow down the inclined bottom in order to be vaporised, the vaporising retort or pan being provided with a heated syphon for the removal of the pitch residuum as deposited, the vapors being conveyed with steam through a heated decomposer; (7) injecting tar or oil into a heated retort by means of a jet of the gases resulting from the previous decomposition of steam by the action of carbon or iron.

Light from Stones—A Phenomenon.

At the agate polishing establishment in Oldenburg, a phenomenon has been observed for the past century that has, as yet, perhaps, attracted too little attention from scientific men. Under very powerful friction, such as can only be produced by the machinery at those works, hard stones had become splendidly luminous and transparent throughout. In this establishment the axis of an undershot water-wheel reaches into the grinding room, where four or five grindstones rotate vertically; over each is brought a gutter, so that a constant small stream of water pours upon the stone. The grindstones themselves are entirely faultless. They are about five feet in diameter, and make three revolutions in a second, so that the grinding surface that passes the object pressed against it amounts to 32 English miles per hour. When grinding, the workman lies on his belly, his chest on a semi-cylindrical hollowed tool, his feet stretched out behind, braced against a post fixed in the floor. With both hands he presses the stone to be polished firmly against the grindstone, bringing his whole weight to bear upon it. The muscular strength brought to bear is very great, and the work performed with intermissions of equal times of rest and work. Some experiments were made in this workshop by Neggerath in broad daylight. He observed that as long as a stone of the hardness of quartz was pressed against the revolving grindstone there was produced an intense red light, which at the same time radiated around the object and emitted numerous sparks. This experience was the same with all hard stones, which appear almost like red hot iron, and it really looks as if the hands must be severely burnt. All the stones become warm in grinding, but not very hot. Chalcedony gave a magnificent fiery red light; chrysoprase, a little red light: rock crystal, a beautiful rose red; coralline, a superb red light, the color being evidently increased by the natural hue of the stone. Amethyst gave a pale violet, while numerous opaque stones gave no light at all.

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Quotations by W. B. Scott & Co., Brokers,

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SEPTEMBER 16, 1875.

☞ All communications will receive particular attention

	Capital.	Par.	Bid.	Asked.
Gas. Co.'s of N. Y. City.				
Harlem	$1,850,000	50	133	131
Manhattan	4,000,000	50	295	300
Metropolitan	2,500,000	100	155	165
" Scrip		..	106	...
Mutual	5,000,000	100	103½	106
New York	4,000,000	100	154	...
Westchester	466,000	50	100	105
Gas Co.'s of Brooklyn.				
Brooklyn	2,000,000	25	245	250
Citizens	1,200,000	20	...	152½
" Scrip		...	101	...
Peoples	1,000,000	10	96	100
" Bonds		...	98	...
" Scrip		...	102½	...
Metropolitan	1,000,000	100	100	102
Nassau	1,000,000	25	124	...
Williamsburgh	1,000,000	50	142	...
" Scrip		...	102	...
Out of Town Gas Companies.				
Buffalo Mutual, N. Y	750,000	100	50	50
Baltimore, Md	2,000,000	100	190	...
Brockport, N. Y	25,000	...	...	90
Citizens, Newark	500,000	...	...	55
Derby of Conn	160,000	100	...	80
East Boston, Mass.		25	112	115
Hannibal, Mo	100,000	100	90	...
Hartford, Conn	700,000	25	41	43
Hempstead, L	40,000	100	...	100
Jersey City	386,000	...	160	...
Jamaica, L. I	25,000	100	...	100
Lewistown, Maine	400,000	100	...	80
Peoples, Jersey City		...	130	65
Peoples of Albany	1,000,000	100	45	...
Peoples of Baltimore		25	108	...
Rochester, N. Y		100	50	...
Fort Wayne, Ind		100	...	105
Woonsocket, R. I	150,000	100	100	...

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[Reported Expressly for this Journal.]

SAPTEMBER 2, 1875.

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Ince Hall	$17 00	@	18 00
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English Caking Coals.			
Newcastle Gas	$5 75	@	00 00
Liverpool caking	11 50	@	12 00
British Province Coals.			
Pictou			2 25
Block House—At Mines, $1.87, Gold			0 00
Caledonia—At Mines, $1.75, Gold			0 00
Little Glace Bay—At Mines, $1.75, Gold			2 00
Lingan—At Mines, $1.75, Gold			0 00
Sydney—Old Mine			3 00
" Reserve, $1.75, Gold Mine			2 25
" International			— —

(Duty, 75 cents per ton, gold. Freight to New York $2 25 currency. Cost of above coals delivered in New York, $5 25 @ $6 00⅞, currency.)

Pennsylvania Coals.			
Penn Gas Coal—At Amboy	$6 50	@	0 00
Westmoreland—At Amboy	6 50	@	0 00
(In New York both the above coals $6 50)			
Shafton	6 50	@	0 00
Youghiogheny	6 50	@	0 00
West Virginia Coals.			
Murphy Run	$6 50	@	0 00
Despard	6 50	@	0 00
West Fairmont	6 50	@	0 00
American Gas Coal	7 40	@	0 00
Fairmont	6 50	@	0 00
Newburgh Orrel	6 50	@	0 00
Pinnickinick	6 50	@	0 00
Cloverhill of Virginia	6 00	@	6 50
McKenzie Compound Mixture			— —
American Cannel Coals.			
Peytona of West Virginia	$12 50	@	00 00
Darlington of Pennsylvania			— —
Cannelton Cannel			11 00
Red Bank—at Philadelphia			6 50
" —at South Amboy			7 25
Asphalts.			
Albertite of New Brunswick	$— 00	@	— 00
Ritchie Mineral of West Virginia	18 00	at	Balt'e.
Trinidad Bitumen	— —	@	14 05

The Penn Gas Coal Company have contracted with the Pittsburgh Gas-Light Co. for their entire supply for the ensuing year from their Youghiogheny mines.

Advertisers Index.

☞ In looking for advertisements, see figures 1 to 12. within brackets, at head of advertisement pages.

GAS BURNERS, APPARATUS, ETC.

American Meter Co.—West 22nd st., N. Y., Arch and 22d st., Phil., 548 Washington st., Boston 11
Cast Iron Gas and Water Pipe—S. Decatur Smith, York and Moyer streets, Phila., Pa 8
Cast Iron Gas and Water Pipes—R. D. Wood & Co., Philadelphia Pa 10
Cast Iron Gas and Water Pipe—Jno. McNeal & Sons, Burlington, N. J. 8
Franklin Foundry and Pipe Works—Jas. Marshall & Co., 23 Nineteenth street, Pittsburgh, Pa. 2
Gas Valves (Chapman) 75 and 77 Kilby st., Boston, Mass. .. 3
Gas-Burners—C. Gefrorer, 248 North 9th st., Phila., Pa. .. 9
Gas Purification—St. John and Cartwright 5
Gas Meters, etc.—Harris, Griffin & Co., 12th and Brown streets, Phila., Pa 10
Gas Meters, etc.—Wm. W. Goodwin & Company, 1012 Filbert street, Phila, Pa 17
Gas Meter Manufacturers—Harris & Bro., 1117 Cherry st., Philadelphia, Pa 11
Gas Fixtures, Etc.—Mitchell, Vance & Co., 597 Broadway .. 7
Gasholders, Etc.—Delly & Fowler, 39 Laurel st., Phila., Pa.. 4
Gas Screen—James P. Mahon, Boston, Mass 5
Gas Engineer—Henry Cartwright, Phil. Pa 4
Lime Hurdles.—Manhattan Lime Hurdle Co., Geo. W. Day, Treas., No. 3 Railroad Square, Haverhill, Mass 2
Lava Tips and Scotch Tips—Charles H. Meyer & Co., 227 Chestnut street, Phil. Pa 8
National Tube Works Co., 78 William St., N. Y 7
Patent Conically Slotted Wood Trays—John L. Cheesman, 147 and 149 Avenue C., N. Y 4
Patent Gas Exhauster—Smith & Sayre, 95 Liberty street .. 4
Pelouze & Audouin Condenser—Jas. R. Smedberg, Sole Agent for U. S. San Francisco, Cal.; Henry Cartwright, 2107 Green street, Phil. Pa 1
Petroleum Gas—J. D. Patton, Trevertou, Pa 4
Patent Gas Exhauster—S. S. Townsend, Agt., 31 Liberty street, N. Y 3

GAS COALS.

Cannelton Coal Co. of West Virginia—J. Tatnall Lea, 325 Chestnut street, Phila, Pa 3
Despard Coal Co.—Parmelee & Bros., Agents, 32 Pine st., New York 7
Gas Coals—Bird, Perkins & Job, 27 South st., N. Y 7
Monongahela Gas Coal—56 Exchange Place, Baltimore, Md. 6
New York and Cleveland Gas Coal Company—384 Penn Avenue, Pittsburgh, Pa 6
Ohio Gas Cannel—G. Merryweather, Pine cor. Wm. sts. Penn Gas Coal Co.—11 Merchants' Exchange, Phil. and 90 Wall street, N. Y 6
Peytona Cannel Coal—S. E. Low, 58 Broadway, N. Y 5
The Newburg Orrel Coal Co.—Chas. W. Hays, Agent in New York, Trinity Building, 111 B'way, Room 7 6
Tyrconnell Gas Coal—52 S. Gay Street, Baltimore, Md 6
Westmoreland Coal Co.—230 South 3rd Street, Phil. Pa 7
Youghiogheny Coal—Perkins & Job, 27 South St N. Y 7

FOUNDRIES.

Atlantic Dock Iron Works—John P. Kennedy, Office 98 Liberty street, N. Y., P. O. Box 2348 .....
Cast-Iron Pipes and Fittings—B. S. Benson, 52 East Monument street, Baltimore, Md .....
Continental Works—T. F. Rowland, Greenpoint 6
Camden Iron Works, Camden, N. J.—Jesse W. Starr & Son. 5
Gloucester Iron Works—J. P. Michellon, Sec., 6 North 7th street, Phila., Pa 4
Mill Street Foundry.—Geo. Stacey & Co., Cincinnati O 5
National Foundry and Pipe Works—Wm. Smith, Carroll, Pike, Smallman & Wilkins streets, Pittsburg, Pa 6
Oregon Iron Foundry.—Herring & Floyd, 740 Greenwich street, N. Y 10
Pascal Iron Works—Morris, Taskar & Co., Philadelphia 12
Providence Steam and Gas Pipe Co., Providence, R. I.—H. A. Branch, Agent 3

WATER METERS, PUMPS, ETC.

Cast Iron Pipes for Water and Gas—Riley A. Brick, 112 Leonard street, N. Y 10
Valves for Water, Steam and Gas—Ludlow Valve Man'g Co., 940 River street, Troy, N. Y 6
Water Pipes, etc.—S. Fulton & Co., 412 Walnut st., Phila ... 7

CLAY RETORT WORKS.

B. Kreischer & Son, Clay Retorts, etc., 58 Goerck st., N. Y. 8
Cheltenham Fire Brick and Clay Retort Works—Evens & Howard, 916 Market street, St. Louis, Mo ....
Manhattan Clay Retort Works, 15th st., near Av. C, N. Y .. 8
Philadelphia Fire Brick Works, Vine and 23d sts., Phila 8

LAMPS, STOVES, PETROLEUM, ETC.

Lamps—M. B. Dyott, 114 South 2nd Street, Phil. Pa. 1
Patent Lamp Post—J. W. Graham, Chillicothe, Ohio, or A. M. Callender, office of this Journal 9

MISCELLANEOUS.

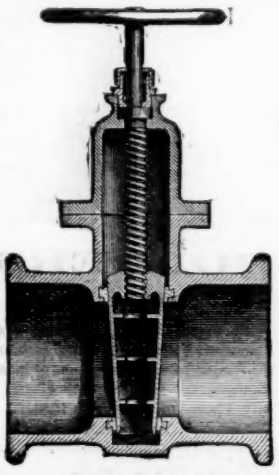
Analysis and Testing of Gas Coals—Prof. Henry Wurtz, 12 Hudson Torrace, Hoboken, N. J. 10
Architect and General Gas Engineer—William Farmer, 111 Broadway Room 95, N. Y 5
Brass Cocks, Plumbers' Materials, etc., etc.—McNab & Harlin Manufacturing Co., 56 John st., N. Y 7
Cements—S. L. Merchant & Company, 76 South st., N. Y...
Contractors for Gas Works, Etc.—Murray & Baker, Fort Wayne, Ind 2
Fodell's System of Bookeeping—A. M. Callender & Co., 42 Pine st., New York 1
Gas Engineer—B. E. Cholar, 914 Olive St., St. Louis, Mo...
Gas-Light Company of America, 63 and 64 Drexel Building, New York 2
Kidd's Gas Consumers Guide—A. M. Callender & Co., 42 Pine Street, N. Y .....
Massachusetts Institute of Technology—Samuel Kneeland Boston, Mass .....
National Coal Gas Company—H. P. Allen, 4 Warren street New York 6
School of Mines, Columbia College, East 49th st 9
Screening Shovels—Herring & Floyd, 740 Greenwich st., New York 7
Scientific and Practical Chemist and Geologist—Profetsor Henry Wurtz, 12 Hudson Terrace, N. J .....
Screening Shovels—G. W. Dean, 1358 Broadway, N. Y. ....
Springfield Gas Machine—Corner Canal and Centre St. ....
Slade's Automatic Fire Governor—Jas. Slade, Gas Works, Yonkers, N. Y .....

CHAPMAN VALVE MANUFACTURING CO.

MANUFACTURERS OF

CHAPMAN GAS VALVES.

Office and Sales Room 75 and 77 Kilby Street, Boston.

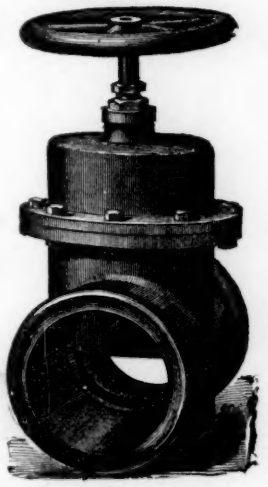


These Valves have been in use for several years, and are pronounced by all who have used them to be

The Best Gas Valves Ever Made.

They afford a direct passage the full size of the pipe. The seats are made of an alloy similar to BABBITT metal, specially prepared for the purpose, and superior to all other metals used for the seats of Gas Valves. It does not corrode under any circumstances to which it is exposed.

There is no LIABILITY OF COHESION between the Gate and Seat, and the Valves can be relied upon to SHUT TIGHT and OPEN EASILY at all times—an important desideratum when used for street mains, in cases of fire.

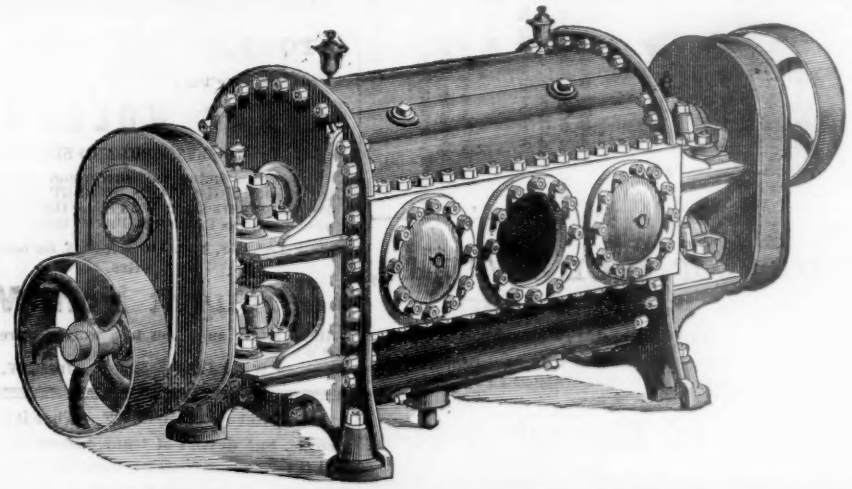


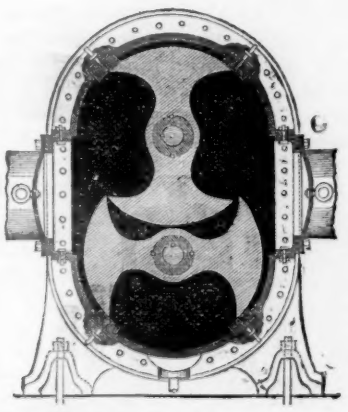
We refer to the following named Gas-Light Companies among the many that have used these Valves:

BOSTON GAS-LIGHT COMPANY, BOSTON, MASS.
CAMBRIDGE GAS-LIGHT COMPANY, CAMBRIDGE, MASS.
NEWTON & WATERTOWN GAS-LIGHT CO., WATERTOWN, MASS.
LAWRENCE GAS-LIGHT COMPANY, LAWRENCE, MASS.
PEOPLES GAS-LIGHT COMPANY, BROOKLYN, N. Y.
CITIZENS GAS-LIGHT COMPANY, BROOKLYN, N. Y.
SOUTH BOSTON GAS-LIGHT COMPANY, BOSTON, MASS.
CHARLESTOWN GAS-LIGHT CO., CHARLESTOWN, MASS.
LYNN GAS-LIGHT COMPANY, LYNN, MASS.
FITCHBURG GAS-LIGHT COMPANY, FITCHBURG, MASS.
CITIZENS GAS-LIGHT COMPANY, NEWARK, N. J.
WILLIAMSBURGH GAS-LIGHT CO., WIRLIAMSBURGH, N. Y.

GAS AND WATER VALVES ½ INCH TO 36 INCHES DIAMETER.
STEAM VALVES ½ INCH TO 12 INCHES DIAMETER.
357-tf

PATENT IMPROVED GAS EXHAUSTER.





P. H. & F. M. ROOTS, PATENTEES AND MANUFACTURERS, CONNERSVILLE, IND.
S. S. TOWNSEND, GENERAL AGENT, 31 LIBERTY STREET, NEW YORK.

The following are some of the advantages we claim for this Exhauster over all others:

FIRST.—It is simpler in its mechanical construction than any other Exhauster in use.

SECOND.—The internal parts consist of only two revolvers, each cast entire in one piece, without a single screw, bolt, nut, washer, key, or other part to get loose on the inside and stop or break the machine. The internal operating parts, therefore, can not get out order, and hence require no care or attention.

THIRD.—Every part of the machine requiring care or attention, as the journals, gearing, etc., is external, easily observed and attended to. All changes, adjustments, and repairs are made from the outside. The journal bearings, if necessary, can be renewed in a few minutes.

FOURTH.—The internal operating parts are practically gas-tight, but are not in actual contact, hence there is no internal friction or wear. The machine is therefore operated with less power than any other.

FIFTH.—They are built in the most complete and substantial manner, with steel shafts and improved journal bearings, and their durability is almost without limit.

We build them of any required capacity, large or small, adapted to any kind of works or place.

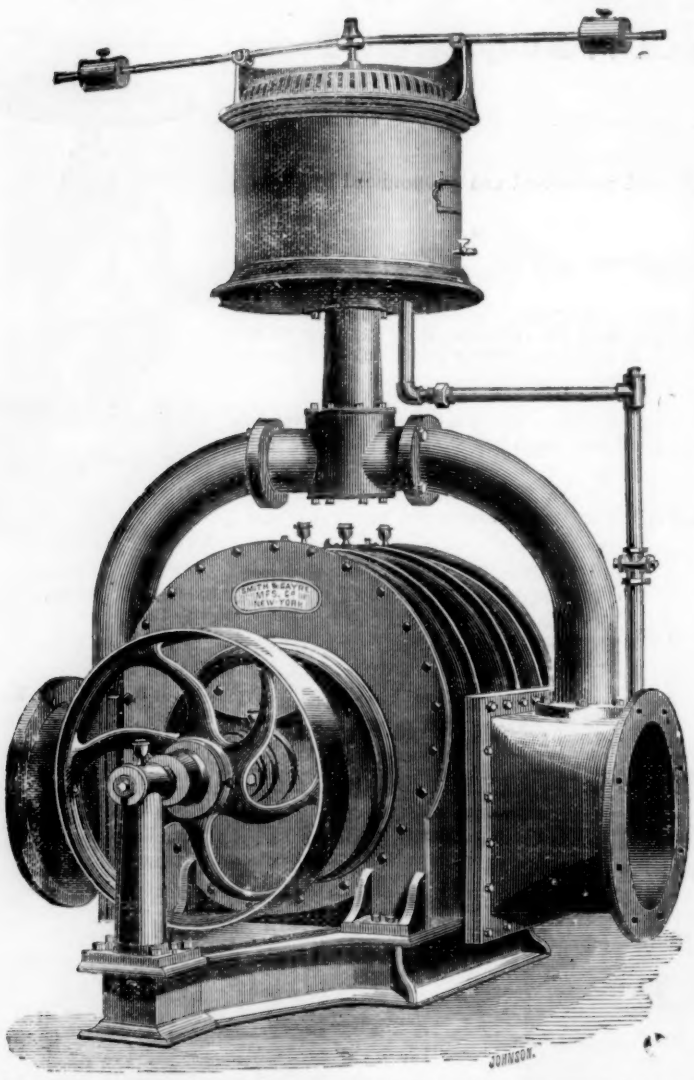
Send for Illustrated Catalogue, giving all particulars as to capacity, speed, power required, dimensions, and price of each size, and references to parties using them.

P. H. & F. M. ROOTS.

SMITH & SAYRE MANUFACTURING COMPANY.

The Mackenzie Patent Gas Exhauster

And Patent Compensator.



They are made to pass from 4,000 to 150,000 cubic feet of gas per hour; will increase the production and illuminating power of the gas, and add very much to the durability of the retorts, either clay or iron. The Compensator obviates entirely the necessity of water-joints, is compact, durable, cleanly, not liable to get out of order, self-acting, quiet, and certain in its operation.

We are also sole proprietors and manufacturers of the

MACKENZIE PATENT BLOWER, PATENT CUPOLA AND SMELTING FURNACE.

The Blower is a Force Blast machine, durably built, and can be driven with one-third the power required to drive the ordinary fan.

The Cupolas are manufactured in sizes to melt from 1 to 90 tons per hour, will save one quarter of the time required by the old style Cupola and 33 per cent fuel. Address

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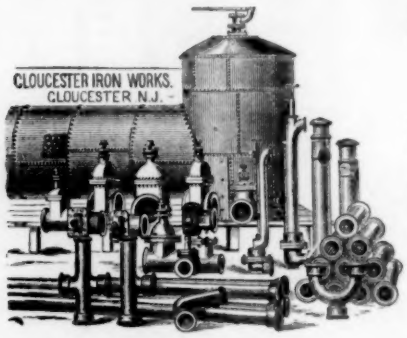
JAMES M. SAYRE, Treasurer.

OFFICE, 95 LIBERTY STREET, New York.

CHARLES W. ISBELL, Secretary.



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OFFICE—NO. 5 NORTH SEVENTH STREET,

PHILADELPHIA.

DAVID S. BROWN, Pres't. JAMES P. MICHELLON Sec'y.
BENJAMIN CHEW, Treas. WILLIAM SEXTON, Sup't.

CAST IRON GAS AND WATER PIPE.

Cast Iron Heating and Steam Pipe. Stop Valves, water or Gas.

Fire Hydrants,

GAS HOLDERS

EVENS & HOWARD,

Manufacturers of a superior quality of

Fire-Brick, Clay Gas Retorts,

Gas Tile, Drain Pipe, Fine Ground Fire Clay, &c.

916 Market Street, St. Louis, Mo.

T. F. ROWLAND,

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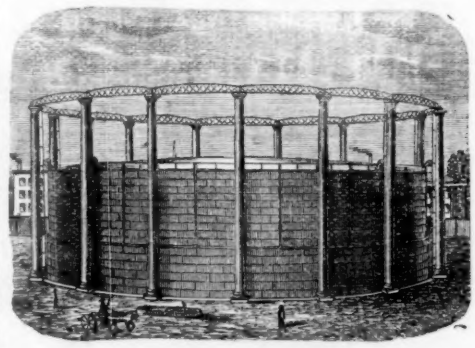
GREENPOINT, BROOKLYN, N. Y.

ENGINEER, AND MANUFACTURERS OF



GAS-HOLDERS

OF ANY MAGNITUDE,

Condensers, Scrubbers, Purifiers, Retorts, Hydraulic Mains and all other articles connected with the Manufacture and Distribution of Gas, furnished with despatch. Plans and Specifications prepared, and Proposals given for the necessary Plans for Lighting Cities, Towns, Mansions, and Manufactories.

JESSE W STARR & SON,

Camden Iron Works

Camden, New Jersey,

Philadelphia Office, People's Bank Building, 435 and 437 Chestnut Sireet.

MANUFACTURERS OF

ALL KINDS OF CASTINGS AND APPARATUS FOR GAS WORKS,

Wrought Iron Roof Frames,

For Retort and other houses Retorts and all castings required for setting them in the latest and most improve model. WASHERS, CONDENSERS, SCRUBBERS and EXHAUSTERS for relieving the Retorts from pressure. PURIFIERS, varyin from 2,000 to 2,000,000 cubic feet daily purifying capacity.

Wrought Iron Lime Sieves

for Purifiers. Station Meters of all sizes.

GAS HOLDERS,

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With cast iron guide and suspension frames. GAS ERNORS or REGULATORS, STREET MAINS, from 1¼ 48 INCHES DIAMETER, for WATER or GAS. Street Main connections, such as BRANCHES, BENDS, DRIPS, SIEVES, etc.

STOP VALVES, from 3 to 30 inches, for both Water and Gas.

Wrought Iron Work.

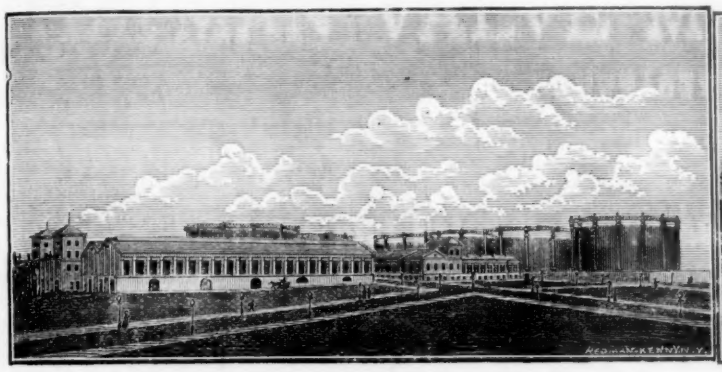
All the Smith and Sheet Iron work required in and abou Gas Works. 226-tf

JESSE W. STARR. JESSE W. STARR, JR.

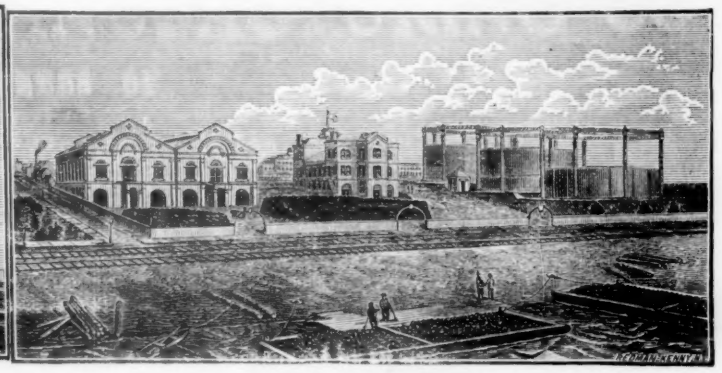
Filtered Water.

S. C. Homersham, in the *Journal of the Society of Arts*, May 28, 1875, holds that spring water from the chalk strata has a uniform annual temperature varying little from 50° Fah. That it is clear, transparent, bright, and, in large bulk, of a pure blue color. That it holds in solution per gallon two or more cubic inches of oxygen and six of nitrogen. That it is free from living organisms, vegetable or animal, and from all dead organic matter, whether in suspension or solution. On the other hand, he urges that filtered river water has in summer a temperature of 68° to 72° F., and in winter of 34° to 36° F. That it is more or less opaque, and devoid of transparency and brightness r that it holds in solution a smaller quantity ef oxygen than does spring water, and that it contains in suspension manure, fæcal matters, living organisms, animal and vegetable, and the virus of specific diseases. He calculates that as the average thickness of the chalk is 800 feet, it would take a depth of 260 feet of rain, or the produce of two centuries, to saturate the pores, and infers hence that so slow and delicate a process of filtration may naturally be expected to produce results superior to the coarse and rapid filtration of water companies.

Two New and important Deposits of graphite have lately been discovered in the district of Trautenau, Bohemia. The thickness of one of them is 8 metres (26 ft. 3 in.), and of the other 1·6 metre (5 ft. 3 in.). In both beds the graphite is said to be very fat, and to furnish an excellent raw material from which to make a lubricant for machinery.—*Journal Society of Arts.*



CINCINNATI GAS WORKS. ERECTED 1871-72-73.—WM FARMER, ENG.,



LACLEDE GAS WORKS, ERECTED 1872.—WM. FARMER, ENG

WILLIAM FARMER.

ARCHITECT AND GENERAL GAS ENGINEER,

111 BROADWAY, TRINITY BUILDING, Room 95, New York.

WILLIAM FARMER may be consulted upon all matters connected with the construction of GAS WORKS, or any other description of buildings. Will furnish General and Detail Drawings, Specifications and Estimates for Gas Works of any capacity.

PATENTEE OF THE FOLLOWING INVENTIONS:

Exhausters for Gas and Foul Lime Ventilation,
Dumping Barrows for Coal, Coke and Lime,
Hydraulic Mains for Retort Benches,
Blowers for Forges, Foundries, &c.
Pumps for Water, &c., &c.

REFERENCES:

Professor SILLIMAN, New Haven, Conn.
GEN. CHAS. ROOME, President Manhattan Gas-Light Company, N. Y.
A. W. BENSON, President Brooklyn Gas-Light Company, Brooklyn, N. Y.
W. W. SCARBOROUGH, President Cincinnati Gas-Light Company, Cincinnati, Ohio.
S. L. HUSTED, President Laclede Gas-Light Company, St. Louis, Mo.
Prof. HENRY WURTZ, Editor AMERICAN GAS-LIGHT JOURNAL, N. Y.
GEN. A. HICKENLOOPER, Vice-President Cincinnati Gas-Light Co., Cincinnati, Ohio
FREDERICK CROMWELL, Vice-President Laclede Gas-Light Company, St. Louis Mo.
C. VANDERVOORT SMITH, Engineer Manhattan Gas-Light Company, N. Y.
JAMES R. SMEDBERG, Consulting Engineer, San Francisco Gas-Light Co., Cal.

P.P. DEILY, 1842. J. FOWLER. 1875.

DEILY & FOWLER,

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Builders of Gas Works.

MANUFACTURERS OF

GAS-HOLDERS,

Single and Telescopic.

WROUGHT IRON ROOF FRAMES,
COAL WAGONS,
COKE BARROWS,

AND ALL

Wrought Iron Work

CONNECTED WITH GAS WORKS.

☞ Particular attention paid to Extensions and Repairs.

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Cast Iron Pipes and Fittings,

AND

Gas and Water Mains.

All sizes from 3 to 30 inch cast vertically in 12½ feet lengths

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DUFFEE'S IMPROVED

GAS SCREEN,

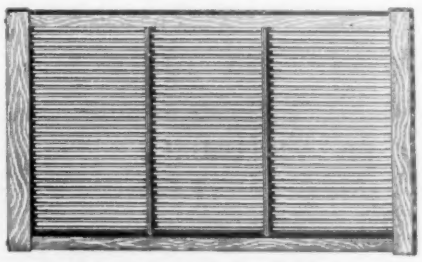
OFFICE 19 TREMONT ROW, ROOM 5,

BOSTON, MASS.

JAMES P. MAHAN, Treasurer.

Manufactory at Haverhill, Mass.

E. DUFFEE, Agent,
Formerly with AMERICAN GAS SCREEN CO.,
Haverhill, Mass.



The Screen is made with an ash or oak frame, perforated with ROUND RATTANS, turned and reeved through, drawing the frame firmly together, strengthening it *without the use of nails or rivets.*

This Screen is reversible, can be used either side up, gives a large purifying capacity; there is no clogging by foul lime, as the rattan presents a smooth surface and can be cleaned very easily. It is considered by all Gas Engineers who have used it to be the best Screen now in use.

☞ Samples sent Free to all Parts of the United States.

All communications should be addressed to

JAMES P. MAHAN,
19 Tremont Row, Room 5.
Boston, Mass.

334-6t

MECHANICAL & GAS ENGINEER.

To Gas-Light Co's.

The undersigned respectfully announces his voluntary resignation of the Vice-Presidency of the American Meter Company from the 1st of March last, after filling that position from its organization in 1863, and now offers his services as

Consulting or Constructing Engineer,

in the erection of new, or the extension of Gas Works.

He is prepared to furnish plans and Specifications, embracing all the latest improvements in the MANUFACTURE OF COAL GAS, at short notice, and on reasonable terms. His experience of THIRTY YEARS in the construction of Gas and Water Works, Railroads, Tunneling, etc., enables him to refer with confidence to any of the Works erected by him, as a guarantee of satisfaction and ability.

By arrangements with reliable manufacturers of all MATERIAL and SUPPLIES used by Gas Companies, he is prepared to furnish promptly all such orders, with best selections, and to give satisfaction as to prices, terms, etc., and respectfully solicits a share of patronage.

HENRY CARTWRIGHT, Gas Engineer,
2107 GREEN STREET, PHILADELPHIA. 379-6t

KIDD'S

Gas Consumers' Guide

Enables every Gas Consumer to ascertain at a glance, without any previous knowledge of the Gas Meter, the quantity and money value of the Gas consumed. Also the best method of obtaining from Gas the largest amount of its light.

It will be to the advantage of Gas Companies to supply their Consumers with one of these Guides, as a means of preventing complaints arising from their want of knowledge in regard to the registration of their meters. For sale by

A. M. CALLENDER & CO.,
42 Pine Street, New York, Room 18,

GAS COALS.

THE
PENN GAS COAL COMPANY

OFFER THEIR

COAL, CAREFULLY SCREENED,

AND PREPARED FOR

GAS PURPOSES.

Their Property is located in the Youghiogheny Coal Basin, near Irwin's and Penn Station, on the Pennsylvania Railroad, and on the Youghiogheny River.

OFFICES

No. 11 Merchants Exchange, Phil'a. 90 Wall Street, New York.

PLACES OF SHIPMENT.

Pennsylvania Railroad, Pier No. 2 (Lower Side).
Greenwich Wharves, Delaware River.
366-1y **Pier No. 1 (Lower Side), South Amboy, N. J.**

CANNELTON COAL CO.

OF WEST VIRGINIA.

Offer for sale the following Coals, from their Colliery at CANNELTON, Kanawha County, West Virginia, delivered at RICHMOND, Va.:

CANNELTON CANNEL,

cknowledged to be the most valuable ENRICHER produced in this country, a gross ton yielding **10,000** ubic feet of GAS of **64·54** CANDLE POWER; COKE **32** bushels, of good quality.

CANNELTON CAKING COAL.

Volatile Matter.	Coke.	Per cent. of Ash in		Sulphur in			Specif. Gravity.	
		Coal.	Coke.	Coke.	Oötl.	Volatile Matter.	Coal.	Gas.
35.1	64.9	2	6	.82	1.48	.66	1.289	.476

MAXIMUM YIELD, **5.06** cubic feet of Gas per pound of Coal—A yield of **4·78** cubic feet per lb.. —gave **16 14-100** Candle-Power.

COKE, of very fine quality—**1453** pounds produced from one ton of coal

SALES AGENTS — **J. TATNALL LEA**, Treasurer, P. O. Box 1747 Philadelphia.
PERKINS & JOB, 27 South Street, N. Y.; 91 State Street, Boston.
H. W. BENEDICT & SON, New Haven.

MONONGAHELA
GAS COAL COMP'Y
Of West Virginia.

OFFICE, 56 EXCHANGE PLACE.
(P. O. Box 432.)
BALTIMORE.

Thomas Gemmell, *President.*
A. Robinson, *Vice-President and Treasurer.*
Benjamin Bissell, *Secretary.*

Mines at Wilsonburg, Harrison Co., W. Va
Shipping Port, Baltimore.

L. S. BOYER & CO, GENERAL SALES AGENTS.

The result of use of this coal in *quantity* by several of the largest gas works in the country, is reported as follows, viz. Yield of gas, 10,000 to 10 500 feet per ton of 2,240 lbs.; illuminating power, 16½ to 17½ standard candles; coke, good in quantity and quality. 350-3m

TYRCONNELL GAS COAL.,

MINED IN TAYLOR COUNTY, WEST VA.

Company's Office, 52 S. Gay St., Baltimore.

CHARLES MACKALL, Secretary.

CHARLES W. HAYS, Agent, Room 7, 111 B'way, N. Y.

Shipping Point—Baltimore, Md.

This coal yields 10,000 cubic feet of Gas, with an illuminating power of over 16 candles. Forty bushels of very superio Coke, with little Ash, and scarcely any clinker. 304-1y

THE NEWBURGH

Orrel Coal Company,

Mines at Newburg, Preston County, W. Va.

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It yields 10,996 cubic feet of gas to the ton of 2,240 lbs. of good illuminating power, and of remarkable purity; one bushel of lime purifying 6,792 cubic feet, with a large amount of coke of good quality.

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The best dry coals shipped, and the promptest attention given to orders. 294-1y

THE DESPARD COAL COMPANY

OFFER THEIR SUPERIOR

DESPARD COAL

To Gas Light Companies throughout the country.

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Company's Office, 29 South street, }

Among the consumers of Despard Coal, we name: Manhattan Gas Light Company, New York; Metropolitan Gas Light Company, New York; Jersey City Gas Light Company, N. J.; Washington Gas Light Company; Portland Gas Light Company, Maine.

*** Reference to them is requested. 204-1y

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GAS COAL COM'Y

Of Pittsburgh, Pa.

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YOUGHIOGHENY GAS COAL.

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This process has been fully tested nearly 50,000,000 cubic feet of Gas having been made under it, and fully demonstrating the fact that it is the greatest improvement ever made in the manufacture of Gas, either for Lighting or Heating purposes. With half a ton of Anthracite Coal 150,000 cubic feet of Gas per day is made from three benches, and the labor is so small that one man can attend three or four benches.

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Numbers 1 and 2.

From best London Manufacturers.

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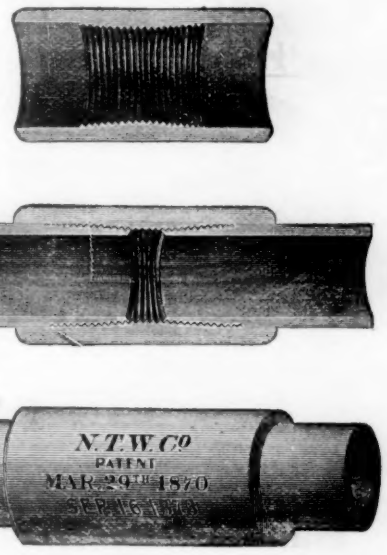

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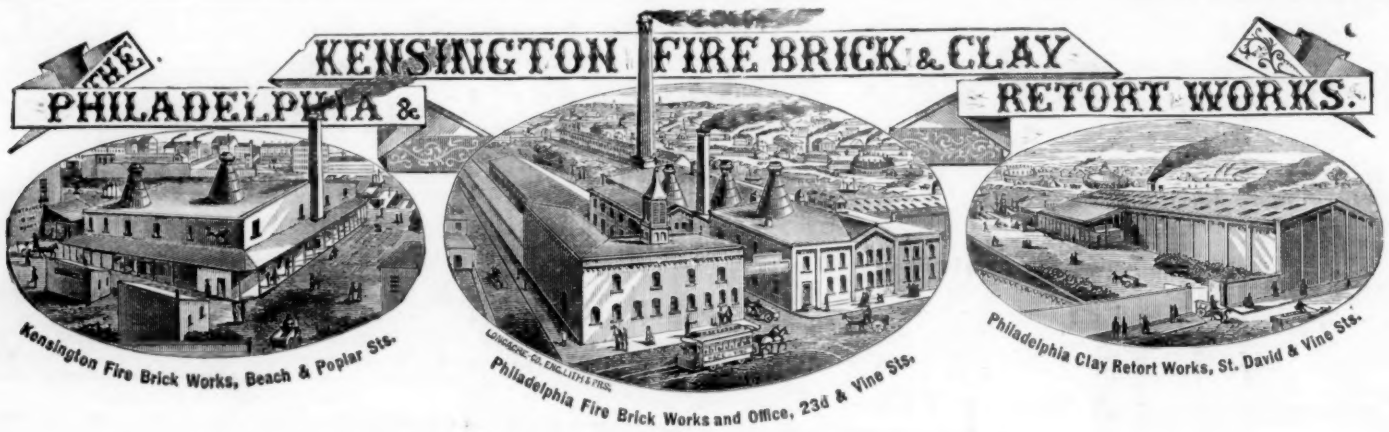
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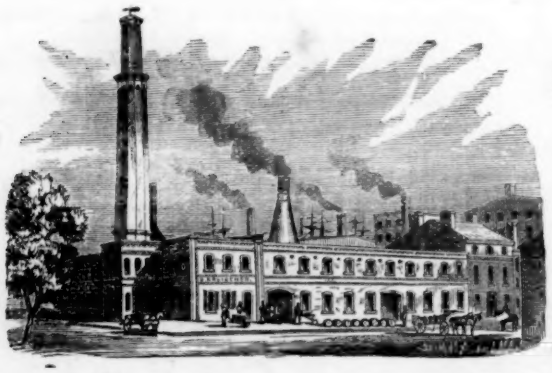

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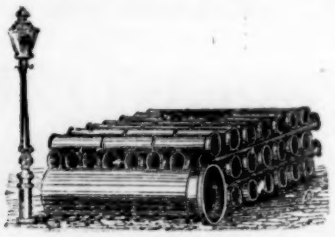

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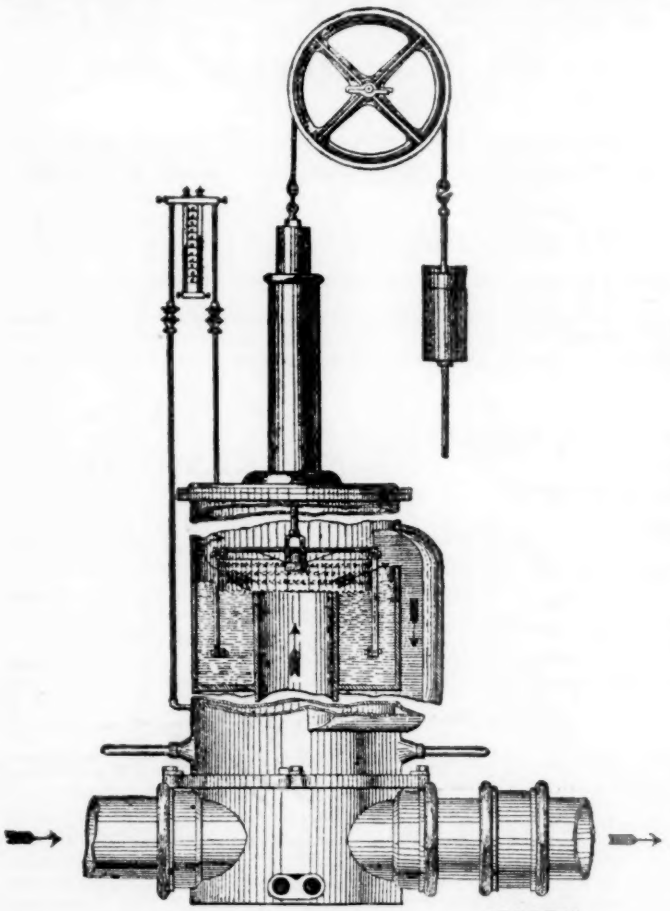

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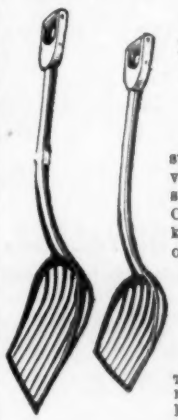

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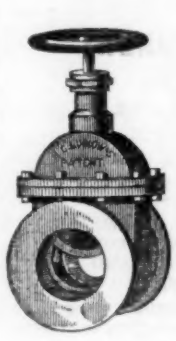

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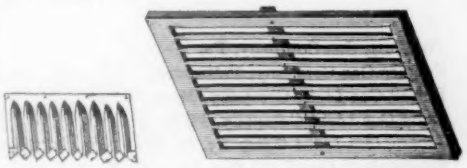

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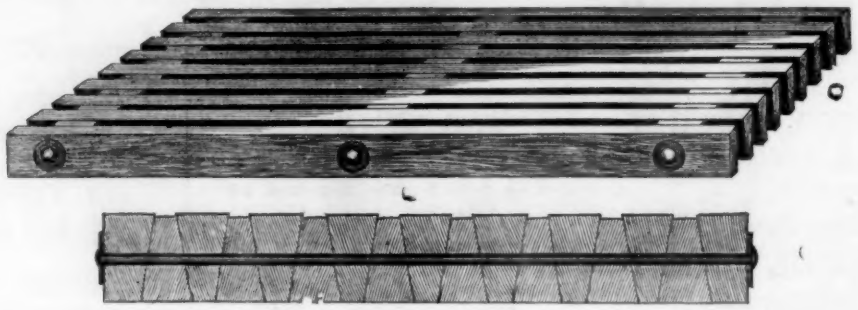

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